EGG 2023 Novi Sad
Phonology at the Interface with Morphosyntax

Florian Breit
Bangor University & University College London

TABLE OF CONTENTS

0. PRELIMINARIES

0.1 Course outline

Our rough plan is as follows (this will change slightly depending on how we get on):

- Session 1: Architecture of the language faculty, the interfaces, modularity in cognitive science and linguistics.
- Sessions 2: Introduction to Distributed Morphology and the morphosyntax–phonology interface; critique of phonological readjustment rules.
- Session 3: Two phonological views: theories which allow allomorph selection within phonology versus those that allow no morphosyntactic information in phonology.
- Session 4: Initial Consonant Mutation and a critique of common approaches to ICM.
- Session 5: Building a strictly modular theory of ICM.
- Bonus if time allows: Exceptionality and impenetrability: how empty phonological structure can account for immutability and domain effects.

0.2 Communication

- For general questions, just ask in class or wherever/whenever you see me around after.
- For individual meetings and personal questions, either just ask me or email me on f.breit@bangor.ac.uk.
- Discussion and debate, both inside and outside class is highly encouraged.
- Any contribution you make will be noted positively, no matter whether you give an expert exposition of some issue, formulate a vague idea, or just ask for clarification or a further question.

0.5 Class

- Classes are in Week 1, from 17h00 to 18h30.
- Class will be based on these lecture notes, so it will be good to keep a copy of them to hand throughout class, to look at examples and to annotate.
  I may occasionally supplement this with handouts or slides, copies of which will be uploaded to the shared Google Drive folder.
- Recommended and optional readings will be uploaded to the Google Drive folder.
- Please bring pen and paper with you to be able to take notes and also to be able to draw diagrams and do workings–we will often use the blackboard and you might want to copy diagrams from this or draw your own to illustrate something.

0.6 Assumptions

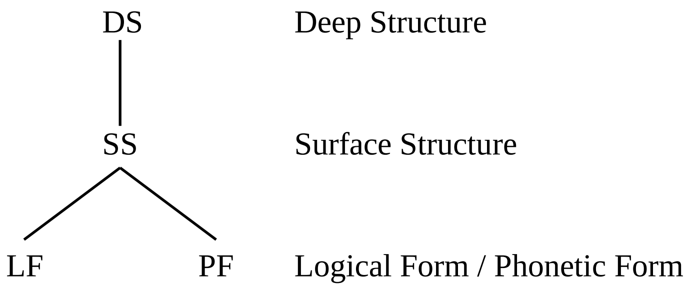
- I assume that you have some basic knowledge of Generative Phonology and Generative Syntax, such as might have been gained through first introductory courses in phonology and syntax.
- If not, no problem – you should be able to follow along but you may have to do some extra reading the first sessions to catch up.
- If anything we do or that I assume is unclear during class, please do let me know, so I can adjust and give enough explanation so everyone can follow – it’s most likely that if you’re unsure about something then so are others in class, too.

1. INTRODUCTION: TOWARD STRICT MODULARITY

1.1 Architecture of the language faculty

1.1.1 The classic Y-model:

The classic Y-model (also T-model) below is the basic architectural assumption in Government & Binding Theory (Chomsky 1981):



The model reflects various *levels of linguistic representation:*

- At the level of Deep Structure, syntax draws on a set of *formatives* (features like [±feminine], [±past], A, N, etc.) and assembles these into hierarchical representations.
- The resultant representations assembled at DS, after having undergone various syntactic processes (called *transformations* in earlier work), form the level of Surface Structure, i.e. the final syntactic representations.
- The syntactic representations of Surface Structure are then further transformed into a Logical Form which feeds semantic computation, and a Phonetic Form which feeds pronunciation.

Minimalist Syntax (Chomsky 1993, 1995) seeks to abandon the syntax-internal levels DS and SS. Instead, computation proceeds roughly as follows:

- The formatives are assembled into syntactic terminals, which are *merged* into pairs, giving rise to hierarchical structure.
- Syntactic processes apply whenever the conditions for them are met. This can happen when a certain terminal (with specific features) enters the structure, or as the result of the structure created by another syntactic process (i.e. potentially every time the structure is changed, this can trigger another process to take place).
- Well-formedness is constrained by (i) what the syntax can build (e.g. it cannot build ternary branching structures), and (ii) by interface conditions.
- Syntactic computations can *converge* or *crash*. They converge if the final syntactic representation is *interpretable* at the LF and PF interfaces, and they crash if they cannot be interpreted at those interfaces (e.g. because the word order is wrong).

The language faculty also has to have some *external* interfaces:

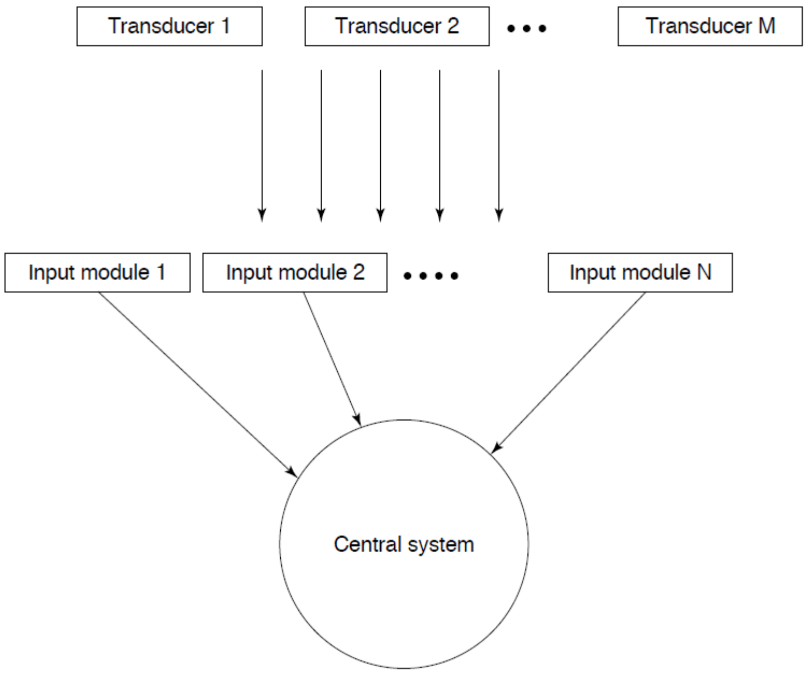
- LF (aka semantics) interfaces with the *Conceptual-Intentional System* (C/I)
- PF (aka phonetics and phonology) interfaces with the *Sensorimotor System* (SM)

We will refine and expand on various aspects of this model as we go.

1.2 Modularity

1.2.1 The modular view of cognition

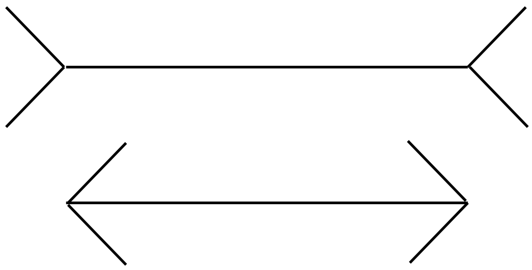
- Many cognitive scientists hypothesise that the human mind is organised into modules.
- Modules are specific, more-or-less self contained, units of the mind which host some specific knowledge and/or perform specific tasks.
- Fodor (1983) proposes that the mind consists chiefly of:
  - Central systems (high level functions, information integration)
  - Input systems (low-level information processors)
  - Transducers (translate between physical and neural signals)



1.2.2 Characteristics of modules

- According to Fodor (1983) modules typically have the following characteristics:
  - Domain-specificity
  - Obligatory processing
  - Informational encapsulation
  - High-speed
  - Restricted access
  - Neural specificity
  - Autonomy
  - Non-assembled
  - Innateness
- Important: It is not necessary that every module has all of these features! Fodor intends this to be a set of features that are typical of most modules.
- Whether any given cognitive module has a specific feature or not is subject to empirical confirmation (our job to find out!)

- However, domain-specificity (and sometimes also informational encapsulation and restricted access) is frequently argued to be an *essential* properties of every module (e.g. Coltheart 1999).
- Domain-specificity means that a module processes only a specific type of information, e.g. speech sounds, and does not respond to information of a different type (e.g. the language faculty does not respond to colour signals).
- It's long been known for example that phonetic processing is not activated by stimulation with non-speech sounds (c. Liberman et al., 1967).
- Restricted access means that the representations and processes inside a module cannot be accessed from the outside (or maybe only in a very limited way). This gives rise to the familiar notion of *implicit knowledge* and implicit processing.
- For instance, you have no direct access to your phonological representations when you speak/hear, or the mix of different cone stimulations when you see colour.
- Restricted access has been well-studied especially in visual cognition, also known there as the cognitive impenetrability of the perceptual system (cf. Pylyshyn 1999).
- Informational encapsulation means that the processes and knowledge contained inside a module is itself unaffected by processing or representations elsewhere.
- For example, if you see a black square ■ you will process this as a black square, even if you know that I intended to really draw a black circle ●. Your conscious knowledge of my intention doesn't influence your perceptual processing of the shape.



(Müller-Lyer illusion)

1.2.3 Computational and intentional modules

- A distinction is sometimes made between *intentional* and *computational* modules (cf. e.g. Segal 1996; Coltheart 1999 calls intentional modules *knowledge modules*).
- Intentional modules consist primarily of a body of knowledge, possibly arranged in specific way. This fits for example a common conception of the lexicon.
- A computational module is a system that provides for the processing of some type of information/representation.
- This is not black and white. Segal (1996) proposes that every computational module realises an intentional module.
- Chomsky's original conception of the modules of the language faculty seems to have been as intentional modules only, which perhaps explains his relatively weak commitment to the above properties of modules.
- There is a definitive trend in generative linguistics to view the modules of the language faculty, especially syntax, morphology and phonology as computational-intentional modules, rather than purely intentional systems.

- Whether you agree with this or not, if the language faculty is a modular input system then we would still expect it to exhibit domain-specificity and probably also restricted access and/or informational encapsulation.

1.2.4 Strict modularity

Domain-specificity, informational encapsulation, and restricted access conspire to isolate a module both informationally and procedurally:

- Computation and information storage in each module proceeds on a set of symbols and structures proprietary to that module and unavailable to other modules/processes.
- The module does not make reference in any form whatever to information from the outside, as encapsulation prevents it from seeking out this information, and restricted access prevents outside processes from feeding it this information.
- We will call this maximally restrictive scenario *strict modularity*.

Strict modularity necessitates translation:

- Information transmitted between two modules (Module A and Module B) must be translated from the information type specific to Module A to the information type specific to Module B.
- In the words of Scheer (2012), such modules "speak different [mental] languages": Module B cannot understand anything said or done by Module A (and vice versa) unless information is translated from Module A's symbols into Module B's symbols in-between.

Let's consider a different scenario: *weak modularity*.

- In a weakly modular world, modules are not isolated in this way, they may be able to access and process external information, or themselves be accessed by other modules.
- As long as they have *some* domain-specific information, they still require translation, but they are not limited in their input-output to information that has undergone translation.
- We could imagine that two hypothetical Modules X and Y processes both some domain-specific and some domain-general information types. Now Module X could pass any domain-general information unhindered to Module Y, or be accessed during computation by module Y, with only minimal if any adjustment of the information contained in the two modules needed in-between.

Is the language faculty strongly or weakly modular?

- Subject to empirical confirmation. That's what we're trying to find out!
- There's (currently) no way we can directly measure or observe this, so we need to rely on inductive reasoning via the scientific method.
- If we can falsify one of the options, the other one can be assumed to be true.
- Weak modularity is unfalsifiable. Consider this thought experiment (Breit 2019:15):
    - Let's assume that all information processed by the mind is domain-general.
    - However, incidentally, some specific piece of information is only ever used by Module X. It potentially could be, but in the individual's life-span or due to the right circumstances not obtaining isn't actually ever used elsewhere (even by central systems).
    - We invent some machine that allows us to directly observe mental processes.

  - Now we could monitor this individual for his whole life-span and proof empirically that this specific piece of information has never ever been accessed or processed by any other mental system other than Module X.
  - This should be strong evidence that there is some domain-specific information, but in fact here it happened to just be accidental, so we cannot reject the hypothesis that this information is domain-specific.
  - Now imagine this is the case with all the information processed by Module X: it's exactly what we'd expect if Module X was strictly modular, but yet we cannot reject weak modularity, because it could just be accidental that none of that information has been made use of elsewhere.
- In comparison, it's easy to falsify strict modularity:
  - As long as we have a good idea of the information processed by Modules A and B, if we can find a phenomenon involving both modules that cannot be accounted for by translation of A-symbols into B-symbols, then the strict modularity hypothesis must be false.
- This means that if we want to be able to say anything about how strictly or weakly modular linguistic systems are, we have to start with the hypothesis that they are strictly modular.
- This hypothesis stands to be refuted by some interface phenomenon that cannot be accounted for without violating strict modularity (we will look at some candidates over the next few weeks).

1.2.5 Some important consequences of (strict) modularity

- Jackendoff (1997:87): "[…] 'mixed' representations should be impossible. Rather, phonological, syntactic, and conceptual representations should be strictly segregated, but coordinated through correspondence rules that constitute the interface."
- In other words, if strict modularity holds, then:
  - Syntax cannot compute or be sensitive to information proprietary to phonology (e.g. stress, what consonant a word ends with).
  - Phonology cannot compute or be sensitive to information proprietary to syntax (e.g. whether a string corresponds to the nominal projection, or the whether some syntactic node has a feature [±def].
- Modularity also crucially determines the types of interfaces we need between modules.
  - Not every module is able to communicate with every other module (for instance, it seems like semantics and phonology have no direct interactions), interfaces are specific to a pair of modules.
  - The job of the interface is to translate all the *relevant* domain-specific information from one module to the corresponding domain-specific information type that is processed by the other module.
  - In a strictly modular world, this means everything that Module B gets from Module A must undergo this translation procedure at the interface.
  - Just how powerful the translation procedure can be is subject to debate.
  - Jackendoff (1997) proposes that interfaces are sort of mini-modules that can do complex processing and rearrangement of information.
  - Most other strict modularists and popular theories of morphology (Distributed Morphology, Nanosyntax, Autosegmental Morphology) assume that translation is strictly list based: a set of A-symbols is matched to a set of B-symbols, but these

correspondences can be environmentally conditioned (i.e. an *"x"* in the context of an *"a"* may be translated as *"$"*, but an *x* in all other contexts is translated as *"£"*).
    - We will look at this in much more detail in the coming weeks, specifically looking at the view espoused by Distributed Morphology (Halle and Marantz 1993).

1.2.6 Strict modularity in syntax but not phonology?

- Something like strict modularity has long been assumed in syntax, where the idea that syntax is not sensitive to phonological information or processing became known early as the Principle of Phonology-Free Syntax (Zwicky 1969).
- Conversely it was (and by many phonologists still is) widely believed that the reverse cannot possibly hold. Rather, Zwicky (1969) proposed a Principle of Superficial Constraints for phonology, which limits access of phonology to "certain (not all) types of information available in artificial syntactic structure" (Zwicky 1969:411).
- Zwicky (1969) explicitly argues that a hypothetical "Principle of Syntax-Free Phonology" would be so obviously untenable we don't even need to seriously entertain the idea.
- Miller et al. (1997) also suggest that syntax-free phonology is untenable, arging that "[n]o one, for example, would attempt to state the rules for the strong and weak pronunciations of English auxiliaries […] without making reference to syntax." (Miller et al. 1997:68).
- This situation is a pretty accurate reflection of the traditional mainstream opinion among linguists: morphosyntax is strictly modular, but phonology is only weakly modular.
- Conversely, in the next 9 weeks, we will seriously entertain the idea that phonology *is* strictly modular and see what the consequences of that are.

1.3 Summary

- The language faculty consists of several modules that interact with one another, these modules constitute input systems in the overall cognitive architecture.
- Domain-specificity, restricted access and informational encapsulation are important prototypical characteristics of modules. A system where modules have all three of these properties can be called *strictly modular*.
- We have to assume the language faculty is strictly modular and try to falsify that, as the reverse (starting by assuming it isn't) is not possible.
- The interface between modules must involve a translation mechanism which matches symbols of a type A specific to one module to symbols of a type B specific to another module.
- Strict modularity has not traditionally received the same serious treatment in phonology as in syntax, but we will make this a core hypothesis.

2. WORD-FORMATION

2.1 The lexicalist approach

2.1.1 The Lexicalist Hypothesis

- Chomsky (1970) proposes that syntactic transformations are not involved in word-formation (derivative and inflectional morphology).
- This means that some phonological processes must already take place in the *lexicon.*

2.1.2 Standard minimalist architecture

- The Minimalist Program (Chomsky 1995) abolishes the representational levels DS (Deep Structure) and SS (Surface Structure).
- Instead, syntax is now more explicitly derivational.
- Syntax draws on an enumeration of syntactic objects that are assembled and manipulated by syntax through repeated application of syntactic processes such as *merge(), move(), search(), copy(),* and *delete()*.
- Syntax proceeds in cycles, called *phases*. At the end of each phase, the material in that phase is frozen and shipped off to PF.
- The content of the syntactic terminals is provided by the lexicon. Lexical entries are complex entities including their semantic properties, syntactic properties (category, selection criteria, …) and phonological form.
- The phonological exponent of a terminal is *present* in the syntax, but *inaccessible* to the syntax (recall the Principle of Phonology-Free Syntax), because syntax only operates on syntactico-semantic features.
- At spell-out (the process feeding the syntactic representation to the interfaces), there is first a level of lexical phonology, which takes care of the morphophonological processes involved in derivational (and maybe inflectional) word-formation, by cyclically applying word-formation rules (e.g. attach the plural suffix *-er* to the stem *buch* 'book' to create [[buch]er]) and then a round of lexical phonological processes apply, which can be specific to the type of word derived (e.g. German umlauting turns *buch* /bu:x/ in [[buch]er] into [büch]er]).

2.1.3 Lexicalism and strict modularity

- The lexicalist view is clearly not compatible with strict modularity:
    1. It assumes that more than one module manipulate phonological representations (the lexicon and the phonology).
    2. It assumes that the lexicon is all-powerful and can access and manipulate both morphosyntactic and phonological representations.
    3. Maybe the idea that phonological representations are present in the actual syntax is also problematic, even if inaccessible, but this is not a commitment held by any (maybe not even most) lexicalists.

- There are some potential remedies for this:
    1. Deny the existence of lexical phonology as distinct from regular phonology.
    2. Deny the lexicalist hypothesis.
    3. Assume the late insertion of phonological material.

2.2 Distributed Morphology

2.2.1 Life without a lexicon

- Halle & Marantz (1993, 1994) propose a different theory of word-formation, known as Distributed Morphology (DM).
- DM rejects the Lexicalist Hypothesis, and together with it the assumption that there is such a thing as a central mental lexical component.
- Instead, the information previously contained in the lexicon is split up across a number if separate lists which can be drawn upon at different levels of representation.

2.2.2 The Formative List and the enumeration

- The *Formative List* (sometimes called List A) consists of bundles of morphosyntactic features such as [+feminine], [D], [+past], some language-specific features (e.g. Latin declension class features such as [I], [II], [IIIa], etc.), and of *roots*.
- Roots are simply arbitrary indices (Harley 2014). They don't themselves contain any syntactic-semantic features–rather they are asemic and atomic. For examples, $\sqrt{3158}$ in English may eventually be spelled out as [fɪʃ] at PF and receive the semantic interpretation ⟦fish⟧ at LF. The only thing that matters to morphosyntax is that $\sqrt{3158}$ is a different root from $\sqrt{3157}$, $\sqrt{3159}$, $\sqrt{271}$, etc.
- For convenience, I'll just use an English label for roots e.g. $\sqrt{fish}$, but assume they are abstract indices not inherently tied to a certain spell-out, as described above.
- Roots don't have a category (noun, verb, adjective, etc.). Rather, they are dominated by a categorising head. These categorisers are usually written with lower-case letters, e.g. *n/nP, v/vP, a/aP*. Whether $\sqrt{fish}$ is realised as the noun *fish*, as the verb *to fish* or as an adjective *fishy* is dependent on whether it has been categorised by *n*, *v*, or *a*.
- The enumeration at the start of morphosyntactic processes draws its material from the Formative List.
- The *Vocabulary List* (aka List B) contains pairings of morphosyntactic formatives with phonological forms. For instance, the English Vocabulary List contains the entries in (1) below:

(1) (a) [Num, +pl] ↔ /-z/
(b) $\sqrt{fish}$ ↔ /fɪʃ/

2.2.3 The Vocabulary List and Vocabulary Insertion

- The Vocabulary List is drawn upon at the interface with PF, and essentially serves to translate morphosyntactic representations into phonological representations at the interface, similar to Jackendoff's (1997) correspondence-rules.
- Entries in the Vocabulary List can be *contextually conditioned*, e.g. the English plural *-en* occurs only in *oxen* for most speakers. Nouns such as *sheep, fish, deer* have a zero plural. Singulars also have a zero marker. Thus, we will have an additional set of` vocabulary entries (VEs) as in (2):

(2) (a) [Num, +pl] ↔ /-en/ / __{$\sqrt{ox}$}
    (b) [Num, +pl] ↔ ∅ / __{$\sqrt{sheep}$, $\sqrt{fish}$, $\sqrt{deer}$, …}
    (c) [Num] ↔ ∅

- DM assumes *Late Insertion*, i.e. that syntactic terminals only acquire their logical/phonological form at the very end of the morphosyntactic computation via list-based translation.
- Vocabulary Insertion (VI) is subject to the Subset Principle (Halle 1997):

  "The phonological exponent of a vocabulary item is inserted into a morpheme in the terminal string if the item matches all or a subset of the grammatical features specified in the terminal morpheme. When several vocabulary items meet the conditions for insertion, the item matching the greatest number of features specified in the terminal morpheme is chosen."

- So, when we want to spell out the plural number marker on the noun *fish* (the root $\sqrt{fish}$), we have to chose VE (2b). We cannot chose (2c) because the entries specifying that [Num] is [+pl] are a more specific match. We cannot chose (2a) because it contains a specification that does not match ($\sqrt{fish}$ is not a possible insertion context for (2a)). We cannot chose (1a) because (2b) is more specific in its contextual specification and still matches the features of the terminal we're trying to spell out, so we have to insert (2b), i.e. ∅ (zero), and ultimately get the phonological form [fɪʃ] without an overt plural marker. This is a case of *contextually conditioned allomorphy* of the plural marker.
- We also find contextually conditioned allomorphy with roots, for examples $\sqrt{person}$ is spelled out as /pi:pəl/ in the context of a [Num, +pl] head, but as /pɜ:sən/ elsewhere.
- Vocabulary Insertion generally applies bottom up (from the deepest embedded syntactic terminal to the least embedded), but some people assume that functional items (i.e. heads) get spelled out first, and then roots. We will discuss this more when it becomes relevant.

2.2.4 The Encyclopaedic List

- Analogous to the Vocabulary List, there is a list matching morphosyntactic terminals to semantic interpretations. For instance:

(3) (a) $\sqrt{fish}$ ↔ ⟦fish⟧
    (b) $\sqrt{eat}$ ↔ ⟦eat⟧

- Similar to Vocabulary Insertion, entries on the Encyclopaedic List can be context-sensitive, giving rise to allosemy. For instance, *kick* in *kick the bucket* means something like *die*:

(4) (a) $\sqrt{kick}$ ↔ ⟦die⟧/__[DP [D +def] [nP $\sqrt{bucket}$]]
    (b) $\sqrt{kick}$↔ ⟦kick⟧

- We won't have much to do with this side of things. So it's enough for us to know that spellout on the LF branch works more-or-less the same way it does on the PF branch.

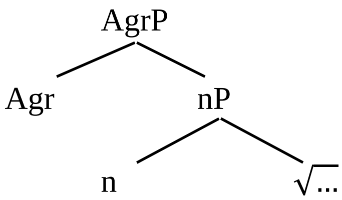
2.2.5 An example: Korean nominal suffixes

- We've seen above that VI can be conditioned by a morphosyntactic context, as was the case with some of the English plural options.
- Conditioning can also be by phonological environment. This happens quite widely in the Korean nominal paradigm (cf. e.g. Sung 2005). For instance, the nominative suffix has two allomorphs: /-ka/ after vowel final, /-i/ after consonant final stems:

(5) /cip/ 'house' → [cipi] 'house.NOM'
/c^ha/ 'car' → [c^haga] 'car.NOM'

- These two suffixes clearly bear so little phonological resemblance that it's pretty clear that this alternation can't be part of phonology.
- So how do we derive this?
- Let's assume that case in Korean is the spellout of an agreement head Agr, which sits above nP. A noun with case would then have the following structure:

(6)



- We have the following entries in the Vocabulary List:

(7) (a) [Agr, nom] ↔ /-ka/ / V___
(b) [Agr, nom] ↔ /-i/
(c) $\sqrt{house}$ ↔ /cip/
(d) $\sqrt{car}$ ↔ /c^ha/

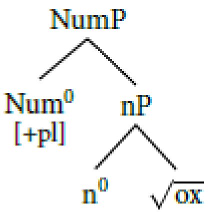
- In (7), the dash at the start of the phonological representation indicates that this is a *suffix*. (7a) further is conditioned by having to be preceded by a vowel. (7b), without any further conditioning factors, is the *elsewhere item* for [Agr, nom] heads.
- Spellout is bottom up, so the root in (6) is spelled out first giving us either /cip/ or /c^ha/.
- Now the categoriser *n* is spelled out. There is no entry in (7), but we can assume that there is a catch-all entry in every Vocabulary List that spells out any leftover terminals as zero (X ↔ ∅). So we now have /cip+∅/ or /c^ha+∅/.
- Next, the head *Agr* is spelled out. If the nP below was /cip+∅/, this does not match the description for (7a), so we have to insert (7b), and get /cip+∅+i/. For /c^ha+∅/ the most specific vocabulary entry matching all the features is (7a), so we get /c^ha+∅+ka/. Regular phonology later turns the /k/ in /c^ha+∅+ka/ into a [g].

2.2.6 Syntax all the way down

- Since there is no lexicon, word-formation cannot take place in the lexicon.
- As we have already seen in 2.5, DM assumes that morphological word-formation is essentially syntactic in nature. Morphology is the spell out process that prepares the syntactic representation for translation at the interface by rearranging terminals and manipulation their features before vocabulary is inserted and structures are sent to phonology.
- There are a number of additional morphological operations that can be performed at this stage, other than just Vocabulary Insertion. These will be largely familiar from syntax.
- *Head movement* targets a head Y^0 in a structure $[_{XP}\ X^0\ [_{YP}\ Y^0\ ]]$, moves it up and head adjoins it to X^0, its immediately c-commanding head. This creates a structure of the form $[_{XP}\ X^0{+}Y^0\ [_{YP}\ t\ ]]$.

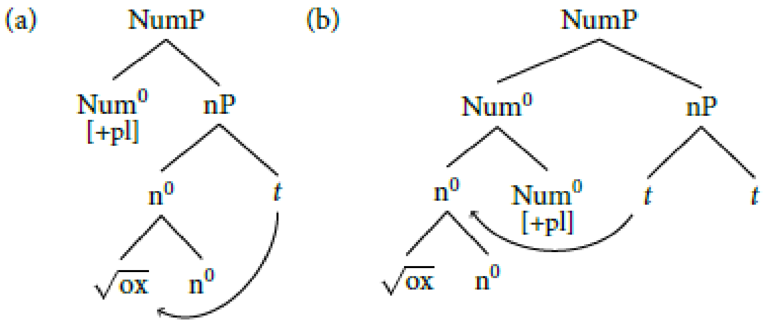
- For example, the English *ox-en* from 2.3 will have the syntactic structure in (8):

(8)



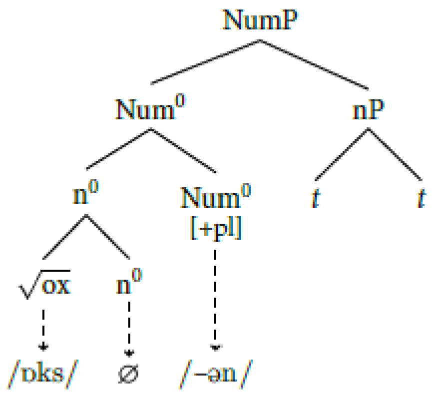
- A structure such as (8) will undergo head movement to create a structure where all of the elements belonging to the "word" unit form a complex head (this is sometimes called the M(orphological)-word domain). As shown in (9a, b), first the root $\sqrt{ox}$ moves and head adjoins to n^0, then the now complex head n^0 moves and head adjoins to Num^0:

(9)



- The structure in (9b) now undergoes VI, as shown in (10):

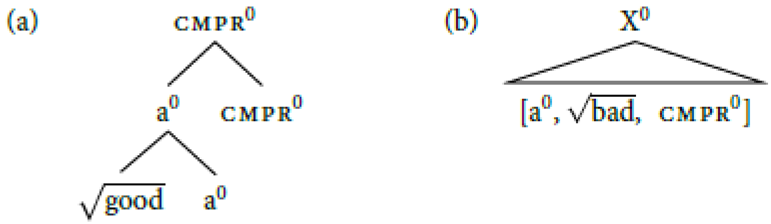
(10)



- *Fusion* is an operation similar to head movement, but rather than create a complex head, it amalgamates the features of two heads to form a single terminal with the features of both.
- Fustion is what gives rise to *portmanteaus*, morphemes where a single vocabulary entry corresponds to multiple syntactic terminals.
- As an example, consider English (synthetic) comparatives. There are three types:
  i. *smart* ↔ *smart-er*
  ii. *good* ↔ *bet-er*
  iii. *bad* ↔ *worse*
- In case (i), we simply have attachment of a comparative suffix *-er*. In case (ii), we have root suppletion (*good*↔*bet*) plus attachment of the comparative suffix, but in (iii), *worse* is a suppletive portmanteau that expones *both* the root *and* the comparative suffix as a single item.

- We can say that a form like *better* has the underlying structure in (11a), without fusion, while in *worse*, the heads have been fused, giving rise to something like (11b).

(11)



- This corresponds to the following entries in the Vocabulary List:

(12)
(a) CMPR ↔ /-ə/
(b) $\sqrt{good}$ ↔ /bɛt/ / ___ CMPR
(c) $\sqrt{good}$ ↔ /gʊd/
(d) $\sqrt{bad}$ ↔ /bæd/
(e) [a, $\sqrt{bad}$, CMPR] ↔ /wɜ:s/

- This means (11a) will be spelled out as /gʊd+Ø+ə/, but (11b) will be spelled out as simplex (12e), i.e. just /wɜ:s/.
- *Fission* is the opposite of fusion, where a head is split up into two separate terminals. For example, in Basque certain person and number features may not appear together, so they are fissioned and realised by two separate morphemes. Namely, second and third person features cannot co-occur with the plural feature, so for instance the 1st person singular absolutive is marked with /n-/ and the first person plural with /g-/, but the second person singular absolutive is marked with prenominal /s-/ only, while the second person plural absolutive is marked with prenominal /s-/ plus postnominal /-e/.
- We won't have much to do with fission here, but see Arregi & Nevins (2012) for more on fission in Basque.
- *Impoverishment* is an operation that deletes features from a terminal node. For example, many languages (including English) only expone gender in the third person: we have *he* and *she*, but no equivalent distinction for *I* or *you*.
- Halle (1997) proposed that the three persons are encoded by two features:

1st: [+author, +participant]
2nd: [–author, +participant]
3rd: [–author, –participant]

- Thus, languages such as English have a *morphotactic constraint* *[+part, ±fem], which even if there is gender agreement in the syntax, cannot expone this on anything that is [+part], where the gender feature is simply deleted before VI.
- Impoverishment always leads to *neutralisation*, similar to word-final obstruent devoicing in phonology, which is due to deletion of a feature (also cf. phonological lenition in general).
- Similarly to lenition in phonology, in extreme cases a terminal can be deleted in its entirety. This is called *obliteration* (Arregi & Nevins 2012).

2.3 Morphophonology in DM

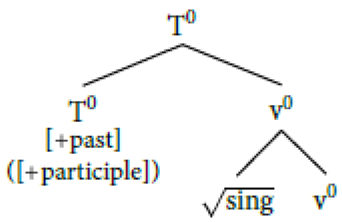
2.3.1 Phonological readjustment rules

- The model presented in Section 2 allows for a decent account of *piece-based morphology*. However, there are many alternations (often inflectional) which are not spelled out by an additional morphological exponent, but rather by an alternation in the phonological form of a morpheme.
- For instance, consider the alternation in English strong class 3 verbs such as *sing* ↔ *sang* ↔ *sung*. Because the same alternation is found in other English verbs such as *begin, cling, drink, sink, swim,* etc., it has been proposed that there should be a morphophonological rule effecting the change in the stem vowel.
- In DM, such morphophonological process are carried out in a stage of derivation immediately following VI, where phonological rules can make explicit reference to the morphosyntactic features around the M-word domain that is spelled out. This component of DM is known as *phonological readjustment.*
- Halle and Marantz (1993) propose the phonological readjustment rules in (13) to account for the class 3 verbs in English:

(13) (a) Rhyme → æ / X ___ [+past, –participle]
(b) Rhyme → ʌ / X ___ [+past, +participle]
where X-Rhyme = $\{\sqrt{sing}, \sqrt{cling}, \ldots\}$

- Under the phonological readjustment analysis, the morphosyntactic objects exponed as *sang* and *sung* have the same structure as piece-based verbs such as *brag* ↔ *bragged*, and *work* ↔ *worked,* namely that in (14). The head T^0 receives zero exponence in the context of a class 3 verb.

(14)



- Phonological readjustment allows us to capture some regularities that would otherwise appear opaque with the piece-based approach presented in Section 2.

2.3.2 Problems with phonological readjustment

- Phonological readjustment rules are clearly incompatible with strict modularity, because they propose a component that manipulates features from two separate modules, morphosyntax and phonology.
- Many of these apparent phonological readjustment processes are extremely limited in their application, e.g. to a handful of words, and not productive, challenging just how prevalent they are. There are possible candidates however where the process appears to be pervasive throughout the language and productive, for instance German Umlaut and Initial Consonant Mutation.
- Additionally, Siddiqi (2006, 2009) points out that the raison d'être of phonological readjustment was the assumption that root suppletion is impossible, but it is clear now that this assumption is wrong, so do we even need it?

- Phonological readjustment is also theoretically undesirable because it assumes a different kind of process to what we believe both morphosyntax and phonology have: phonological readjustment involves transformation rules, while modern syntax and phonology are both derivational, driven by certain principles, parameters and well-formedness conditions.
- Further, phonological readjustment rules produce a somewhat strange effect where the thing they expone still exists as a piece but is virtually always itself left unexponed (i.e. receives zero exponence). This unnecessarily proliferates morphological zero-elements and makes the mapping between morphosyntax and phonology harder. Elsewhere, head fusion has been adopted to avoid precisely this situation, so why should it be okay for readjustment?
- Finally, phonological readjustment rules present us with a problem of analytic underdetermination: there are no clear criteria for deciding whether something like English class 3 verbs is a case of suppletion or a case of phonological readjustment.
  As Merchant (2015, p. 282) puts it:
  > "Without a criterion for deciding when a morphophonological readjustment rules is involved […] the appeal to unspecified readjustment rules threatens to be no better than Justice Stewart's famous criterion for recognizing pornography ('I know it when I see it')".

2.4 Summary

- The Lexicalist Hypothesis leads to theoretical bloating and is problematic in terms of modularity, without providing clear benefits over other approaches.
- Distributed Morphology rejects the Lexicalist Hypothesis, and assumes "syntax all the way down" → word-formation is a post-syntactic spellout process that manipulates morphosyntactic terminals.
- The morphosyntax deals only with morphosyntactic features and abstract roots, phonological and semantic information is only inserted at the interface to PF/LF, via Vocabulary Insertion.
- Vocabulary Insertion involves competition via the Subset Principle: you must insert the most specific vocabulary entry available.
- The core of DM only seems to account for piece-based morphology, and it has been proposed that there is a (post-morphological) stage of phonological readjustment to take care of morphophonological stem alternations such as *sing, sang, sung*.
- Phonological readjustment rules are really problematic, both from the point of modularity, theoretical consistency and analytic criteria.
- Our question for next week is thus: are there alternatives to phonological readjustment that don't have the same problems and can successfully account for all the data?

3. MODULARITY AND MORPHOPHONOLOGY

3.1 Morphophonology in DM

3.1.1 Phonological readjustment rules

- Distributed morphology primarily accounts for *piece-based morphology*. So, how do we deal with morphology that is exponed by a phonological alternation in a stem?
- Example: English strong class 3 verbs:

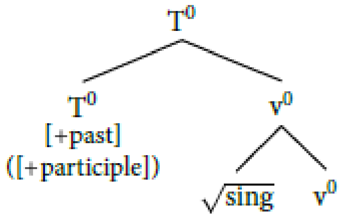
(1)	Stem	↔	Stem.PST	↔	Stem.PST.PART
	sing	↔	*sang*	↔	*sung*
	begin	↔	*began*	↔	*begun*
	drink	↔	*drank*	↔	*drunk*

- Halle & Marantz (1993) propose that such morphophonological alternations take place during *phonological readjustment.*
- Halle and Marantz (1993) propose the phonological readjustment rules in (2):

(2) (a) Rhyme → æ / X ___ [+past, –participle]
(b) Rhyme → ʌ / X ___ [+past, +participle]
where X-Rhyme = $\{\sqrt{sing}, \sqrt{cling}, \ldots\}$

- Note that *sing, sang, sung* all have the same morphosyntactic structure:

(3)



- Phonological readjustment allows us to capture some regularities that would otherwise appear opaque with the piece-based approach presented in Section 2.

3.1.2 Problems with phonological readjustment

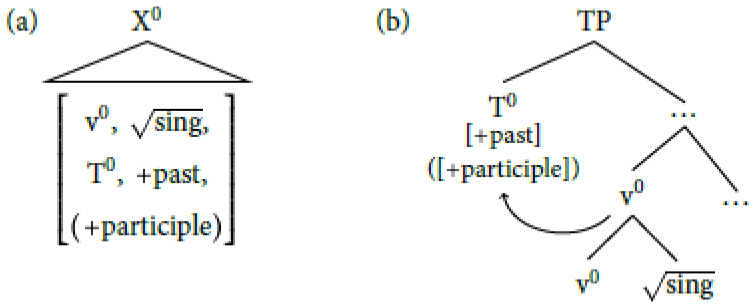
- We saw last week that there are a number of problems with having a phonological readjustment component in our grammar:
  - Phonological readjustment violates strict modularity.
  - Introduces transformational rules into a derivational grammar.
  - Proliferation of zero exponence/problem of double exponence.
  - Not sure if there really is a need if we allow root suppletion (Siddiqi 2010).
  - Typical undergoers are fraught with exceptions.
  - Analytic underdetermination: how do we know when it is suppletion vs. when it is a phonological readjustment rule (cf. Merchant 2015)?

3.1.3 Root suppletion as an alternative?

- If the alternation in (1) isn't due to a phonological readjustment rule, then it must be lexicalised in the form of root suppletion, i.e. speakers have memorised the alternants.
- This is in line with neurophysiological (ERP) evidence which suggests that irregular English verbs do not show any sign of compositionality in processing, suggesting they are stored as whole forms in the Vocabulary List (cf. Newman et al. 2009).

- I suggest that this means that the structure in (3) is fused into a single head X as in (4a), via v-to-T head movement as shown in (4b).

(4)



- Roots such as $\sqrt{\text{sing}}$ will then each have three exponents, as shown in (5):

(5) (a) [v, $\sqrt{\text{sing}}$, T, +past, +participle] ↔ /sʌŋ/
(b) [v, $\sqrt{\text{sing}}$, T, +past] ↔ /sæŋ/
(c) $\sqrt{\text{sing}}$ ↔ /sɪŋ/

- The Subset Principle means that the exponent /sʌŋ/ is only chosen for a fused head consisting of both the nodes v and T and the root $\sqrt{\text{sing}}$ and carrying both the features [+past, +participle]. Conversely, for a non-participle past form (5a) is too specific and cannot be inserted, but (5b) and (5c) compete for insertion. Again, if this is fused and marked [+past], then (5b) /sæŋ/ being the most specific candidate will be inserted. (5c), /sɪŋ/, is the elsewhere item and will be inserted in all other circumstances where the root $\sqrt{\text{sing}}$ occurs, e.g. when T is [–past], or in nominalisations (with a second level categoriser *n*), or in derivational nominalisations such as *sing-er*.
- Consider also other irregular examples such as the Class 2 strong verb *choose* ~ *chose* ~ *chosen*, which notably shows a past-participle marker /–n/. Under the readjustment analysis, we need a different set of readjustment rules here, plus a rule exempting the past participle from readjustment and adding the semi-regular morphological past participle exponent /-n/.
- Under a suppletion analysis of *choose*, we can simply exclude *choose* from the set of roots that trigger fusion as in (4a). $\sqrt{\text{choose}}$ has two exponents /tʃus/ (the elsewhere item) and /tʃɔʊs/ contextually specified for an adjacent head T[+past]. T[+past, +participle] will independently receive the spell-out /-n/ as it remains a separate head and so is subject to VI after v has been inserted. Viz. the vocabulary entries in (6):

(6) (a) [T, +past, +participle] ↔ /–n/ / ___ {x: x is a strong verb}
(b) [T, +past, –participle] ↔ ∅ / ___ {x: x is a strong verb}
(c) $\sqrt{\text{choose}}$ ↔ /tʃɔʊs/ / __ T[+past]
(d) $\sqrt{\text{choose}}$ ↔ /tʃus/

- A root suppletion analysis is also consistent with the fact that the entire system of irregular verb tenses in English shows a large degree of variation and a very small number of roots that take part in for each variation. Compare this to Table 1 below.

Class	**Pattern**	**Example**	**Count**
Class 1	ABBn	*bite ~ bit ~ bitte-n*	10
	ABA	*drive ~ drove ~ drive-n*	8
Class 2	ABBn	*choose ~ chose ~ chose-n*	2
	ABC	*cleave ~ cleft ~ clove*	1
	ABCn	*fly ~ flew ~ flow-n*	1
	ABB	*shoot ~ shot ~ shot*	2
Class 3	ABC	*begin ~ begun ~ began*	11
	ABB (ou)	*bind ~ bound ~ bound*	3
	ABB (u)	*fling ~ flung ~ flung*	10
	ABB (a)	*stink ~ stank ~ stank*	1
	ABBn	*swell ~ swole ~ swole-n*	1
	AAdAd	*swell ~ swell-ed ~ swell-ed*	1
Class 4	ABBn	*bare ~ bore ~ bor-n(e)*	11
	ABB	*come ~ came ~ came*	1
Class 5	ABAn	*eat ~ ate ~ eat-en*	3
	ABBn	*lie ~ lay ~ lai-n*	1
	ABB	*sit ~ sat ~ sat*	2
Class 6	ABAn (a)	*shake ~ shook ~ shake-n*	3
	ABAn (e)	*draw ~ drew ~ draw-n*	2
	ABB	*stand ~ stood ~ stood*	1
	AAdAd	*lade ~ lad-ed ~ lade-n*	2
	AAdAd	*lade ~ lad-ed ~ lad-ed*	2
Class 7	ABAn	*fall ~ fell ~ fall-en*	6
	ABAd	*hang ~ hung ~ hanged*	1
	AABn	*beat ~ beat ~ beat-en*	1
	ABB (u)	*hang ~ hung ~ hung*	1
	ABB (e)	*hold ~ held ~ held*	1

Table 1: Classes and subpatterns of English strong verbs.

- As is readily apparent from Table 1, we would need a large plentitude of different morphophonological rules *and* combinations thereof with piece-based exponents for groups showing *-n* participle or *-ed* past **marking.**
- In total there are 89 of these irregular forms, for which we would roughly need: 89 vocabulary entries, 27 readjustment rules, and 4 spell-out rules for T.
- A full suppletion analysis would roughly require: 186 vocabulary entries[1], 0 readjustment rules, and 3 spell-out rules for T.[2]

[1] 5×1 for AAA, 71×2 for ABB or ABA, 13×3 for ABC.
[2] AAdAd will subsume to the elsewhere case for T and won't need to be specified specifically for some roots.

- Thus, readjustment rules (assuming they are as easy on memory as vocabulary entries; they are probably more costly) will save us only the storage of 78 pieces of information. Consequently, a suppletion analysis of English strong verbs is not as uneconomical as one might expect.

3.2 German Umlaut

3.2.1 Introduction

- Umlaut is a phonologically regular, wide-spread and productive process in German which involves the fronting of a root vowel when certain suffixes are attached to a stem, such as the plural suffixes *-e* /–ə/ or *-er* /–ɐ/, the adjectival marker –lich /–lɪç/, the diminutive suffix –chen /–çɛn/, and a number of others.
- The data in (7) illustrate a number of nouns in the singular and plural, with the latter form exhibiting Umlaut:

(7)	*Singular*	*Plural*	*Gloss*
	Sack [sak]	*Säcke* [s**ɛ**kə]	‘sack(s)’
	Topf [tɔpf]	*Töpfe* [t**œ**pfə]	‘pot(s)’
	Luft [lʊft]	*Lüfte* [l**ʏ**ftə]	‘sky/skies’
	Laus [laʊs]	*Läuse* [lɔ**ʏ**sə]	‘louse/lice’

- As can be seen from (7), umlaut involves the fronting of the root vowel, keeping all other properties of the vowel in tact. In the case of an umlaut (e.g. *Laus*), the right-most segment in the diphthong undergoes the regular fronting change, which in turn triggers a change of the diphthong’s first vowel. This change in the diphthong’s first vowel can be put down to regular phonology, as *[aʏ] is phonotactically illegal in German, so that the change [a] → [ɔ] here is simply a phonotactic repair.
- Embick & Halle (2005) suggest that Umlaut can be accounted for with a readjustment rule such as that in (8), which applies to a root when it is next to one of the umlaut-triggering suffixes:

(8) *Umlaut Rule:* V → [-back] / ___ {x: x is a suffix which triggers umlaut}

- However, Umlaut does not always apply when a normally Umlaut-triggering suffix is attached to some stem/root, as illustrated in (9):

(9)	(a)	*Ausdruck* [ʔaʊsdʁʊk]	*Ausdrücke* [ʔaʊsdʁ**ʏ**kə]	‘expression(s)’
		Ausdruck [ʔaʊsdʁʊk]	*Ausdrucke* [ʔaʊsdʁʊkə]	‘print(s)’
	(b)	*Mann* [man]	*männlich* [m**ɛ**nlɪç]	‘man/male’
		Amt [ʔamt]	*amtlich* [ʔamtlɪç]	‘office/official’

- This effect cannot be down to the root alone. For example, *Amt* which does not umlaut in (9b) can undergo Umlaut when it is pluralised as in (10):

(10) *Amt* [ʔamt] *Ämter* [ʔ**ɛ**mtɐ] ‘office(s)’

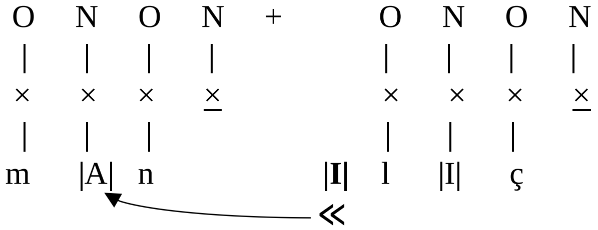
- Thus, the rule in (8) for Embick & Halle actually cannot be made general at all, as would be suggested by the productivity of umlauting. Rather, every possible combination of a root plus umlaut-triggering affix must be liste as a context for the readjustment rule to take place.
- So the set of conditions triggering rule (8) will contain members such as {$\sqrt{\text{man}}$+[+pl], $\sqrt{\text{man}}$+[a], $\sqrt{\text{office}}$+[+pl], …} but crucially exclude combinations such as $\sqrt{\text{office}}$+[a].

- Of course this means that *Ausdruck* ‘expression’ and *Audruck* ‘print’ in German must be accidental homophones which have different roots, viz. $\sqrt{\text{print}}$ and $\sqrt{\text{express}}$, which is supported by their different semantic interpretations (different entries in the Encyclopaedic List).

3.2.2 A floating-element analysis of Umlaut

- *Proposal:* Umlaut triggers are equipped with a floating element |I| (roughly the feature [+front] in classical Feature Theory). This floating feature docks onto the rhyme of an adjacent stem when concatenated, as shown in (11):

(11)



- *Incorporation* of the floating |I| into the first nucleus in (11) will give rise there to the representation |A,I|, which gets realised as the front mid vowel [ɛ].
- Since Umlaut can always be accounted for by incorporating |I| into the undergoing vowel, we don’t need a phonological readjustment rule—incorporation can be left up to the regular phonology: whenever there is some floating material, try to attach it to something to realise it (this maxime is quite common in phonology, actually).[3]
- However, we’re in no better position to account for “irregular” behaviour of Umlaut illustrated in (9). Arguably, the situation is worse: if the floating element is always present with the suffix *–lich*, and umlauting happens in regular phonology where no reference to the morphosyntax is possible, then *amtlich* should really be **ämtlich*. Umlaut should be entirely regular.
- We will see that in fact, Umlaut is entirely regular, and the absence of Umlaut on *amtlich* has a structural explanation that doesn’t need to make modularity-violating reference to morphosyntactic or phonological information across modules.

3.2.3 A piece-based account of Umlaut

- Lowenstamm (2012) systematically investigates the behaviour of umlaut-triggering suffixes in German.
- First, we can divide suffixes in general in three broad categories:
    1. Some suffixes always trigger Umlaut, e.g. the plural –er /–ɐ/ ‘–s’.
    2. Some suffixes trigger Umlaut sporadically, e.g. –lich /–lɪç/ ‘–ly’.
    3. Some suffixes never trigger Umlaut, e.g. –schaft /–ʃaft/ ‘–ship’.
- Category (iii) is easy to account for: these suffixes simply don’t contain the floating element |I|.
- The challenge lies in explaining why (a) the sporadic Umlaut triggers in (ii) sometimes do and sometimes don’t trigger Umlaut, and (b) why the consistent triggers in (i) never show such variability.

---

[3] For instance, in Optimality Theory it appears in the guise of a whole set of constraints militating against deletion, known as the “MAX” constraints. Sometimes an explicit constraint MAXFLT specifically maximising the output realisation of floating material is adopted. In OT morphology, it is additionally implied in the widely-adopted constraint REALIZEMORPHEME, which requires that every input morpheme corresponds to some unit in the output. See e,g, Trommer (2008) for an example discussing both MAXFLT and REALIZEMORPHEME.

- While it is often argued that case (ii) just involves irregularity that has to be memorised (perhaps like what happens with English strong verbs, and involving root suppletion), Lowenstamm argues that, given the regularity and productivity of the process otherwise, the data in (9b) must have a simpler explanation, namely:

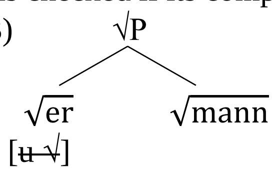
> "The environment for the application of Umlaut was met in the case of *männlich*, but not in the case of *amtlich*." (Lowenstamm 2012:2).

- Our job then consists in identifying what (structural) differences there are in the word formation of *männlich* and *amtlich*.
- There are two basic observations about the environment of Umlaut which Lowenstamm argues can give us a first clue:
    a) Umlaut requires strict structural adjacency: we get *Vater* 'father' ↔ *väter-lich* 'fatherly', but *Vaterschaft* 'paternity' ↔ *vaterschaftlich* 'paternally' (**väterschaftlich*).
    b) Umlaut only targets the head of the most deeply embedded phrase within the domain. This rules out Umlaut targeting a suffix (e.g. **vaterschäftlich*) and likewise in compounds means it is the head of the compound that undergoes Umlaut (i.e. we have *Tat-sache* 'fact, lit. act-thing' ↔ *tatsächlich*, but **tätsachlich* is ungrammatical).
- As we have seen above, the sporadic Umlaut trigger *–lich* can attach to both roots, compounds, and complex stems containing other suffixes. Lowenstamm observes that this is in contrast to persistent Umlaut triggers like plural *–er*.
- Persistent Umlaut triggers like plural *–er* can *only* attach to bare (unaffixed) stems:

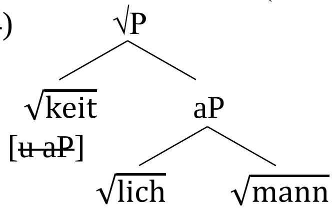
(12)	*Singular*	*Plural*	*Ill-formed*	*Gloss*
	Amt	*Ämt-er*	**Amt-en*	'office(s)'
	Amtszeit	*Amtszeit-en*	**Amtszeit-er*	'term(s) of office'
	Mann	*Männer*	**Mann-en*	'man/men'
	Mannschaft	*Mannschaft-en*	**Mannschaft-er*	'team(s)'

- So, if the plural for complex stems is *–en*, which never triggers Umlaut, not *–er*, which always triggers Umlaut, Lowenstamm suggests, then maybe the same structural difference underlies *–lich* when it does and doesn't trigger Umlaut? That is, –lich triggers Umlaut when it is attached to a bare stem, but not when it is attached to a complex stem.
- Lowenstamm (2012) suggests that some affixes themselves are roots, rather than simply functional heads like *a*.
- Assuming the three suffixes *–er* (plural, persistent trigger), *–lich* (adjectiviser, sporadic) and *–schaft* (–ship, non-trigger) are all roots ($\sqrt{\text{er}}$, $\sqrt{\text{lich}}$, $\sqrt{\text{schaft}}$), we can first infer that they must be *bound roots* (aka cranberry morphemes, like *cran*-). As such, they are associated with a selectional restriction in the form of an uninterpretable category feature which prevents them from occurring independently.
- A root that can only attach to other roots has an uninterpretable selectional feature [u √] which is checked if its complement is a root, as in (13):

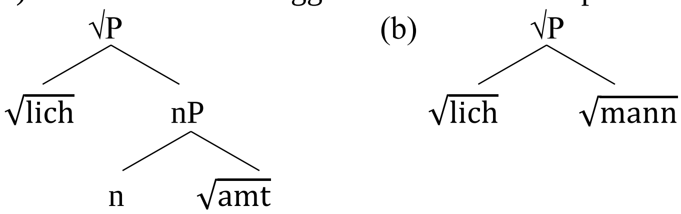
(13)



- Conversely, non-triggering suffixes typically attach to categories, not to roots, e.g. the suffix *–keit* '–hood' selects an aP (it has an uninterpretable feature [u aP]), as in (14):

(14)


- Suffixes that select categories as their complement are invariably unable to trigger Umlaut in German. Therefore, Lowenstamm reasons, suffixes such as √lich which have variable behaviour can be attached either to a bare stem *or* to a category. In the former case they behave exactly like √er in (13) and trigger Umlaut, in the latter they behave exactly like √keit in (14) and are unable to trigger Umlaut. The two possibilities are shown in (15):

(15) (a) (b)


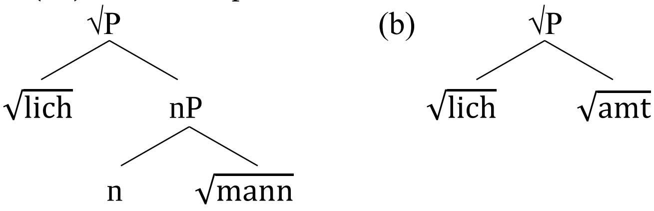
amt-Ø-lich *männ-lich*

- In both cases, the vocabulary entry for √lich contains the floating |I| as shown in (11), however, in (15a) the floating |I| cannot reach √amt because the nP constitutes a phase, which is spelled out before the √P dominating it. This means that the nP will be sent to phonology first and form a phonological domain [amt], before attaching the suffix to give the phonologically complex domain [[amt] ≪|I| lich]. Floating melody cannot be incorporated across domain boundaries in the phonology.
Conversely, in *männ-lich* in (15b), the two roots will be concatenated before being sent to phonology for computation, and thus form a single domain [mann ≪|I| lich], so that the floating |I| can be successfully incorporated into the nucleus to its left.

3.2.4 Why is there no **ämtlich* and no **mannlich*?

- Lowenstamm's account predicts that sporadic Umlaut triggers such as *–lich* should be able to attach both to categorised and uncategorised roots. Consequently, the inverse structures to (15), given in (16), should be possible also:

(16) (a) (b)



mann-Ø-lich *ämt-lich*

- While these forms are indeed unattested in German, they are in the category which Hale & Reiss (2008) term *attestable*. That is, they are well-formed and native-speaker intuitions are that they are possible words in the language, but they just haven't happened to be part of their lexicon, similar to the accidental non-presence of the plausible English work *blick*.
- Lowenstamm suggests that this is precisely the case with *ämtlich* and *mannlich*: they are possible words of German but speakers just haven't "invented" them yet.
- We can actually go a little further and explore why speakers produce the structures in (15) rather than those in (16). I will suggest that this is due to the entries they have in their Encyclopaedic list, viz. (17) below:

(17) $\sqrt{\text{amt}} \leftrightarrow [\![\text{office}]\!]$ / ___ n
$\sqrt{\text{man}} \leftrightarrow [\![\text{man}]\!]$ / ___ n
$\sqrt{\text{man}} \leftrightarrow [\![\text{male}]\!]$
$\sqrt{\text{lich}} \leftrightarrow \lambda x[\text{pertains-to}(x)]$

- In (17), notice that $\sqrt{\text{amt}}$ only acquires its semantic interpretation as ⟦office⟧ when it is nominalised, meaning that semantic conversion requires (15a) rather than (16b), and we consequently have a fixed interpretation in German where *amtlich* can only mean "official" as it pertains to the actions of an office or office-holder, compositionally derived from from an office. This is consistent with at least my own judgment, where I perceive *ämtlich* as well-formed but meaningless.
- Conversely, in (17), $\sqrt{\text{man}}$ generally refers to the property of the male, and so (15b) has a very wide scope for interpretation, from "male" to "masculine" to "in the way of a man". Unattested (16a) again is well-formed, and although unattested intuitively has a much narrower interpretation. *Mannlich* without Umlaut can only mean "in the way of a man", as the interpretation of the nP is fixed to an individuative reading of a male person.
- If this idea is correct, it predicts that all the roots that do not show Umlaut with suffixes such as *–lich* have restrictive nominal-derived readings, and together with that perhaps may also be generally more restricted in their category distribution. For instance, there is no direct verbalisation of $\sqrt{\text{amt}}$ in German. Instead, German only has noun-derived *amtieren* and periphrastic *ein Amt ausüben*, but not a direct verbalisation **amten* (cf. *walten/verwalten*).

3.3 Summary

- Readjustment rules should be rejected on theoretical grounds, not least because they violate strict modularity.
- In a strictly modular model of the grammar, morphophonology must be the result of suppletion or actual phonology.
- In turn, this means that the conditions for morphophonological alternations must be describable in terms of morphosyntactic structure or general (i.e. non-morpheme specific) phonological structure.
- The division into phonology and suppletion gives us a clear criterion for telling the two apart: if it is productive it is phonological, if not it is suppletive.
- Different to readjustment rules, this situation makes actual predictions:
    - Phonological processes must be consistent with the wider phonology of the language (no special treatment for certain morphemes or classes of morphemes is possible), and phonological alternations must be triggered by some phonological object which expones some morphosyntactic object.
    - Conversely, in the case of suppletion we predict high levels of irregularity and variations across time and socio-/dia-/idio-lects.
- We saw that both these predictions are borne out by looking at Umlaut in German, which turned out to be phonologically highly regular, with apparent exceptions explained in terms of the morphosyntactic structure rather than VI or phonology itself, and by looking further at English strong verbs, which show high irregularity and instability consistent with a suppletion analysis, and where there is also neurophysiological evidence suggesting they are processed atomically, consistent with the fusional analysis underpinning a suppletion account.

4. THE EMERGENCE OF THE UNMARKED

4.1 Precis: Optimality Theory

4.1.1 The basics of an OT grammar

- OT (Prince & Smolensky 1993) proposes that, rather than arbitrary rewrite rules, phonological alternations arise from the grammar trying to find an optimal solution to the problem of trying to satisfy conflicting constraints on phonological well-formedness.
- An OT Grammar consists of three components: GEN, CON and EVAL.
- GEN, aka the Generator, takes as its input a phonological objects and will output a set of all the possible outputs that could be derived from it by altering its structure and/or features. These outputs are called *candidates*.
- For instance, for an input /bɛtəɹ/ it may return a set of candidates including all of the following: [bɛtəɹ], [bɛtə], [bɛtɹ], [bɛtɹ̩], [bɛtɚ], [bɛɾəɹ], [bɛɾə], [bɛɾɹ], [bɛɾɹ̩], [bɛɾɚ], but also e.g. [btɹ], [t], [ɛ], [ ] (nothing), [əbɛɾəɹə] and many more (in fact, the candidate set is countably infinite). We usually only write down (subjectively) plausible or otherwise illustrative ones.
- CON is the set of Constraints. Constraints come in two basic types: *Markedness constraints* and *faithfulness constraints*. Markedness constraints impose restrictions on what is considered a well-formed output (e.g. "don't have a coda consonant", "don't have branching onsets"). Faithfulness constraints militate against modification of the input (e.g. "don't change feature values", "don't delete/add segments").
- Constraints are *ranked* relative to each other, and this ordering is language specific, so one language might give more importance to not having codas than to not deleting segments, resulting in the disappearance of word-final coda consonants, while another language might have the opposite ranking, resulting in the preservation of coda consonants in the output.
- EVAL, aka the Evaluator, evaluates a set of candidates against a set of constraints, and so determines the optimal candidate. It does this by going through the set of constraints, starting with the highest ranked, and eliminating all the forms that violate it, until only one candidate is left. If all the candidates violate a certain constraint, then only the candidates with the fewest violations survive to the next round.

- Here's how to derive the plurals of *cat*, *dog*, and *house* in English in OT:

/kæt + z/	*SIBSIB	AGR(voi)	MAX	DEP	IDENT(voi)
a. kætz		*!			
b. ☞ kæts					*
c. kætɪz				*!	
d. kætɪs				*!	*
e. kæt			*!		

Tableau 1: Deriving the plural of cat.

/dɔg + z/	*SIBSIB	AGR(voi)	MAX	DEP	IDENT(voi)
a. ☞ dɔgz					
b. dɔgs		*!			*
c. dɔgɪz				*!	
d. dɔgɪs				*!	*
e. dɔg			*!		

Tableau 2: Deriving the plural of dog.

/haʊs + z/	*SIBSIB	AGR(voi)	MAX	DEP	IDENT(voi)
a. haʊsz	*!	*			
b. haʊss	*!				*
c. ☞ haʊsɪz				*	
d. haʊsɪs				*	*!
e. haʊ			*!		

Tableau 3: Deriving the plural of house.

4.1.2 Some common constraints

- MAX: Assign one violation mark for every segment in the input that has no correspondent in the output.
- DEP: Assign one violation mark for every segment in the output that has no correspondent in the input.
- ONSET: Assign one violation mark for every onsetless syllable.
- NO-CODA: Assign one violation mark for every coda consonant.
- AGR(F): Assign one violation for every sequence of two segments that don't agree in their value for the feature [F].[4]
- IDENT(F): Assign one violation for every segment where the value for the feature [F] differs between the input and the output.

[4] This definition is a bit sloppy: really, Agr(F) as used in the English Tableaux in Section 1.1 refers specifically to sequences where the second segment is a sibilant. There can be different Agr constraints for different relations between specific types of segments, e.g. vowels in a nucleus or sequences involving nasals.

4.2 Baix Empordà Catalan (BEC)

4.2.1 Alveolar assimilation in BEC (and Central Catalan more widely)

- In BEC, final alveolar stops undergo total assimilation with a following segment, though nasality is always preserved. This is shown in the data in (1):

	In isolation	*Gloss*	*Assimilated*	*Gloss*
(1)	[tot]	‘all’	[ton nədal]	‘all Christmas’
	[tot]	‘all’	[tol lo bɔ]	‘all the good’
	[tot]	‘all’	[top pər tu]	‘all for you’
	[gat]	‘cat’	[gan nɛgɾə]	‘black cat’
	[gat]	‘cat’	[gam mɔrt]	‘dead cat’
	[fet]	‘done’	[fem mol]	‘done very …’
	[bɔn]	‘good’	[bɔm biblistə]	‘good Bible scholar’

- However, note that liquids do not undergo this type of assimilation:

	In isolation	*Gloss*	*Assimilated*	*Gloss*
(2)	[pəɾ]	‘for’	[pəɾ nədal]	‘for Christmas’
	[pəɾ]	‘for’	[pəɾ lo bɔ]	‘for the good’
	[pəɾ]	‘for’	[pəɾ tu]	‘for you’
	[pəɾ]	‘for’	[pəɾ mol]	‘for very …’
	[mar]	‘sea’	[mar nɛgɾə]	‘Black Sea’
	[mar]	‘sea’	[mar mɔrt]	‘Dead Sea’

4.2.2 Overassimilation in BEC

- In BEC, but not Central Catalan more widely, the infinitival marker /-ɾ/ undergoes total assimilation preceding enclitics, as shown in (3).

	In isolation	*Gloss*	*With enclitic*	*Gloss*
(3)	[puzaɾ]	‘to put’	[puzam-mə]	‘to put me’
	[puzaɾ]	‘to put’	[puzal-lə]	‘to put it.FEM’
	[puzaɾ]	‘to put’	[puzal-li]	‘to put him/her.DAT’
	[puzaɾ]	‘to put’	[puzas-sə]	‘to put oneself’
	[puzaɾ]	‘to put’	[puzat-tə]	‘to put you’
	[puzaɾ]	‘to put’	[puzal-ləs]	‘to put them.FEM’
	[puzaɾ]	‘to put’	[puzan-nə]	‘to put some’
	[fəɾ]	‘to do’	[fəl-lə]	‘to do it.FEM’
	[fəɾ]	‘to do’	[fən-nə]	‘to do some’

- As can be seen further from (4), the infinitival marker is always /-ɾ/ before vowel-initial enclitics:

	In isolation	*Gloss*	*With enclitic*	*Gloss*
(4)	[puzaɾ]	‘to put’	[puzaɾ-u]	‘to put it’
	[puzaɾ]	‘to put’	[puzaɾ-i]	‘to put there’
	[fəɾ]	‘to put’	[fəɾ-u]	‘to do it’
	[fəɾ]	‘to put’	[fəɾ-i]	‘to do there’

- Note that this behaviour is specific to the infinitival marker, any other final liquids do not undergo assimilation of any form, just as shown in (2) above.

4.2.3 An unsatisfactory analysis

- The regular alveolar assimilation process in (1) is quite clearly just regular phonology, so we won't have to worry about that.
- BEC overassimilation however cannot be part of the regular phonology. While it looks superficially like the regular assimilation of Central Catalan, it is limited both to a specific morphological environment (pronominal encliticisation) and to a specific morpheme, namely the infinitival marker.
- One very naïve way to account for this is to propose that the infinitival marker is fully suppletive, much like English strong verbs (*sing~sang~sung*). Under such an analysis the infinitival marker would have the vocabulary entries in (5), with phonological conditioning of all the allomorphs except the default /-ɾ/

(5) *Vocabulary Entries for* inf *in Baix Empordà Catalan:*

a. [T, inf] ↔ /-n/ / ___ [+nasal]
b. [T, inf] ↔ /-l/ / ___ [l]
c. [T, inf] ↔ /-t/ / ___ [t]
d. [T, inf] ↔ /-s/ / ___ [s]
e. [T, inf] ↔ /-ɾ/

- Note the absence of a variant /-m/ in (5), this is because (5a) will subsequently simply undergo regular nasal place assimilation, so 'to put me' will be spelled out as /puz-a-n=mə/, followed by regular phonological nasal place assimilation leading to the surface form [puzam-mə].
- Many morphophonologists would claim that the solution in (5) is unsatisfactory, as it fails to capture in any meanigful way the fact that what we have here looks like it is some sort of phonologically natural assimilation process.[5]

4.3 TETU: The Emergence of the Unmarked

4.3.1 Mascaró's (2007) theory of external allomorphy

- Mascaró (and many other morphophonologists) makes a distinction between *external* and *internal* allomorphy.
- External allomorphy involves alternations which are conditioned by (at least some) factors that are not part of the underlying representation inserted.
- In contrast, in internal allomorphy the phonological representations contain all the factors required to determine the alternation.
- BEC overassimilation is sensitive to the specific morpheme involved, therefore a case of external allomorphy.
- Mascaró (2007) argues that, similar to how in internal allomorphy regular phonological considerations lead to the emergence of the phonologically least marked/most optimal candidate, patterns of external allomorphy show the emergence of a lexically unmarked form under certain conditions.
- In the case of BEC, [t] is a phonologically less marked segment than [ɾ], so given the choice between {n, l, t, s, ɾ}, all else being equal, the phonological constraint ranking of BEC would lead to a preference for [t], and we would expect this to emerge in the forms in (4), where the infinitival is followed by a V-initial enclitic. Clearly, however, the least marked candidate that surfaces in the "elsewhere environment" in this case is [ɾ], not [t].

[5] Note that this is a subjective judgement. Just because it looks like a banana doesn't mean it isn't be a plantain.

- Mascaró's theory builds on the assumption that the vocabulary entry for a terminal can contain more than one unconditioned alternants, something that would ordinarily lead to free variation. For instance English *either* has two common pronunciations, /aɪðə/ and /iːðə/, which for some speakers are selected fairly randomly and can be said to be in free variation. Such a speaker might have the vocabulary entries in (6):
  (6) *Vocabulary Entries for* either*:*
    a. *either* ↔ /iːðə/
    b. *either* ↔ /aɪðə/
- Because (6a) and (6b) have no conditions, they can be freely inserted whenever.
- Mascaró (like many other researchers in OT) also assumes that where multiple allomorphs can be inserted, these will all enter the phonology together, and phonology might choose one allomorph over another. So if the two entires in (6) were in the vocabulary list of a speaker who's grammar disfavours long vowels over diphthongs (e.g. via a transfer effect from Spanish in an L2 grammar), the form in (6b) would usually surface based on phonological considerations alone.
- On top of these two assumptions, Mascaró (2007) proposes that in order to account for lexical TETU effects such as the surfacing of [ɾ] for the BEC infinitival marker in the elsewhere condition, the lexicon (aka vocabulary list) must allow for a relative ranking of unconditioned allomorphs, so that these form a partially ordered set.
- For example, in the case of BEC overassimilation, Mascaró proposes that the vocabulary entry is as in (7):
  (7) *Vocabulary Entry for* inf *in BEC:*
    [T, inf] ↔ { ɾ > n, l, t, s, }
- In (7), {*a* > *b, c, …*} indicates that *a* has lexical priority for insertion over *b*, *c*, etc., where *b, c, …* themselves have no internal ordering and if *a* is rules out will thus behave like free variants. In other cases, further orderings could optain, e.g. {*a* > *b, c* > *d, e, …*} would mean that *a* has priority over *b, c, d, e, …*, but if *a* is ruled out then *b*, *c* (which themselves are now free variants) will have priority over *d, e, …*.
- Mascaró proposes that the partial ordering which encodes prioritisation lexically is mirrored in OT by a constraint PRIORITY, which assigns a violation mark for every violated lexical priority relation (e.g. insertion of *b* in {*a* > *b* > *c* > *…*} gives one mark, insertion of *c* gives two marks, etc.).

4.3.2 Mascaró's (2007) analysis of Baix Empordà Catalan

- Let's first look at regular /t/-assimilation in BEC.
- We'll use the following set of constraints for this:[6]
  - IDENT(nas): Assigns 1 violation mark for each output segment that is [–nas] where the correspondent input segment is [+nas].
  - IDENT(F): Assigns 1 violation mark for each feature value that is different in the input segment compared to its associated output segment.
  - AGREE/STOP: Assign one violation mark for each (alveolar) stop that doesn't agree in its feature values with a following segment.
  - AGREE/C: Assign one violation mark for each consonant that doesn't agree in its feature values with a following segment.

[6] Mascaró doesn't use IDENT(nas) in his paper, because he doesn't show an explicit analysis of nasal-final segments, but it is implicitly assumed that nasality faithfulness outranks full stop agreement.

- We can construct the following ranking arguments:
  - IDENT(nas) must outrank all other constraints, because nasality is never lost.
  - Since only alveolar stops undergo complete assimilation, and not all consonants, AGREE/STOP must outrank the general AGREE/C.
  - IDENT(F) outranks AGREE/C because we see no agreement in any segment that isn't subject to AGREE/STOP.
- We are now in a position to see what happens in a phrase such as /əkɛt maɾ maj/ 'this sea never'. This is illustrated in Tableau 4 below.

/əkɛt maɾ maj/	IDENT(nas)	AGREE/STOP	IDENT(F)	AGREE/C
a. əkɛt maɾ maj		*!		**
b. ☞ əkɛm maɾ maj			*	*
c. əkɛt mam maj		*!	*	*
d. əkɛm mam maj			**!	

Tableau 4: Deriving regular Central Catalan alveolar assimilation on an oral stop.

- In Tableau 4, [əkɛt] in candidates (a) and (c) is rules out by violations of AGREE/STOP, in favour of assimilated [əkɛm] in candidates (b) and (d). Although candidate (d) is best in terms of AGREE/C, it involves two violations of IDENT(F) where candidate (b) only involves one violation of IDENT(F), meaning that candidate (b) with assimilation only of the alveolar stop is the optimal candidate and wins.
- Compare this to a form involving an underlying final alveolar nasal, as shown for /bɔn biblista/ 'good Bible scholar' in Tableau 5 below.

/bɔn biblista/	IDENT(nas)	AGREE/STOP	IDENT(F)	AGREE/C
a. bɔn biblistə		*!		*
b. ☞ bɔm biblistə			*	*
c. bɔb biblistə	*!		*	*

Tableau 5: Deriving regular Central Catalan alveolar assimilation on a nasal stop.

- As can be seen in Tableau 5, IDENT(nas) rules out full assimilation in candidate (c), while AGREE/STOP rules out the fully faithful candidate in (a), so that candidate (b) which shows both stop agreement and maintains nasality will win.
- Let's now look at BEC overassimilation. First we'll look at the elsewhere case, where we should see the lexically unmarked [ɾ] surface before a vowel-initial enclitic. This is shown for /pɔza-ɾ=u/ 'to put it' in Tableau 6.

/pɔza-{ɾ > n, l, t, s}=u/	ID(nas)	AGR/STOP	ID(F)	AGR/C	PRIORITY
a. ☞ puza-ɾ-u					
b. puza-n-u					*!
c. puza-l-u					*!
d. puza-t-u					*!
e. puza-s-u					*!

Tableau 6: Deriving BEC overassimilation with a vowel-initial enclitic.

- In Tableau 6, because the variation in all the candidates (a-e) is not due to a phonological change, but rather due to an alternate underlying form, none of the IDENTITY constraints are triggered. The AGREE constraints don't have any effect because there is no consonant-consonant sequence involved. So the only arbiter is Mascaró's PRIORITY constraint, which rules out all the allomorphs except the one which is lexically ranked the highest, i.e. candidate (a).
- Let's compare this to what happens in the cases where we have an enclitic that starts with a consonant, say in /pɔza-ɾ=la/ 'to put it.FEM'. This is shown in Tableau 7.

/pɔza-{ɾ > n, l, t, s}=la/	ID(nas)	AGR/STOP	ID(F)	AGR/C	PRIORITY
a. puza-ɾ-lə				*!	
b. puza-n-lə		*!		*	*
c. ☞ puza-l-lə					*
d. puza-t-lə		*!		*	*
e. puza-s-lə				*!	*

Tableau 7: Deriving BEC overassimilation with a vowel-initial enclitic.

- As can be seen in Tableau 7, while the violations of PRIORITY are the same as in Tableau 6, the other constraints needed for the regular assimilation process actually rule out the other candidates. The lexically unmarked candidate (a), as well as the alveolar fricative candidate (e) are ruled out by AGREE/C, while the forms with /n, t/ in candidates (b) and (d) are already ruled out by AGREE/STOP. Candidate (c) is the only one that violates neither of the AGREE constraints and therefore will be the winner.

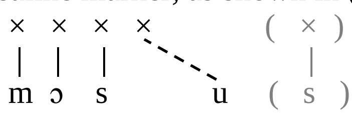
4.3.3 A brief appraisal

- The persuasiveness of Mascaró's proposal lies in the fact it connects phonological markedness effects (constraint rankings already in the phonology) with allomorph selection, while still allowing for the idiosyncracies associated with external allomorphy, such as different lexically encoded, morpheme-specific markedness considerations.
- On the scale between treating BEC overassimilation as a regular phonological process and completely arbitrary, phonologically conditioned allomorphy, Mascaró's theory is a half-way house, incorporating phonological considerations on the one hand but also requiring explicit listing of the allomorphic candidates on the other hand.
- In terms of modularity, inserting multiple allomorphs into the phonology and then letting them compete there is not a violation of modularity per-se, even if it requires an extension of the VI process as well as an extension of what phonology (GEN and EVAL in this case) is able to do.
  However, having constraints such as PRIORITY is potentially problematic, because they refer to extra-phonological information, in this case lexical information about allomorph markedness. Priority is perhaps what we might call a "mild modularity violator", because that information is not necessarily contained specifically in another module (depends on the conception of the lexicon and where/how these rankings are encoded). As we will see next week, there are some proposals for allomorph selection inside phonology that are much worse in terms of modularity.

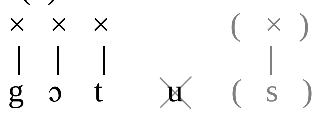
4.4 A different approach to phonologically optimising allomorphy

4.4.1 Scheer's (2016) proposal

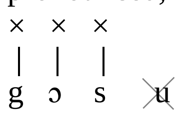
- Scheer (2016) conducts a survey of phonologically conditioned allomorphy, with a view to: i) identify alternations which are problematic from a modular perspective, and ii) show that phonological conditioning of morphological operations is blind to melody (i.e. you can only see structure, but not the features of segments in exponents).
- Expanding on an earlier proposal by Faust (2014), Scheer proposes that cases such as the cases of external allomorphy discussed by Mascaró (2017) can be analysed without reference to separate lexically listed underlying forms. Instead, he proposes that where the alternation is phonologically optimising (i.e. leading to a phonologically less marked outcome), there is a single, unified underlying representation which contains all of the alternating segments but leaving them unattached, so that they can compete for realisation in the phonology.
- As an example, let's consider the realisation of the masculine marker /–u/ in Catalan. On some masculine nouns the marker is always overt, e.g. [mɔsu] 'boy' (pl. [mɔsus]).
  On some masculine nouns the marker is generally zero, e.g. [gɔt] 'glass' (pl. [gɔts]).
  However, on sibilant-final masc. nouns, the marker is visible iff they are followed by a sibilant-initial suffix, e.g. [gɔs] 'dog', pl. [gɔsus].
- Scheer (2016) proposes that the masculine marker itself is just a floating vowel [u], which is not attached to a skeletal slot and so will not normally be realised. However, the underlying form of items that always show an overt marker end in an empty skeletal slot which can host the masculine marker, as shown in (8):

(8) 

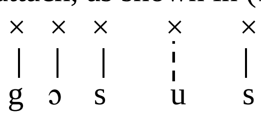
- Conversely, items that never show the masculine marker like [gɔt] 'glass' don't have a final empty skeletal slot, so that the floating [u] cannot be realised and goes unpronounced, as shown in (9):

(9) 

- This is the same for forms such as [gɔs] 'dog', which only show an overt masculine marker if they are followed by another sibilant. There is no final skeletal slot, so the floating [u] will remain unpronounced, as shown in (10):

(10) 

- However, because Catalan phonology generally prohibits sibilant-sibilant sequences (OT has a constraint *SIBSIB for this, which is very common cross-linguistically), an epenthesis process inserts an additional skeletal point between the two sibilants, to which the floating [u] can now attach, as shown in (11):

(11) 

- In Scheer's version, there is just one underlying representation, where a theory such as Mascaró (or complete external suppletion) would require two: [u] and ∅.

4.4.2 A single underlier analysis of BEC overassimilation

- I propose that BEC overassimilation can be analysed in a similar way to what Faust (2014) and Scheer (2016) propose.
- I suggest that the BEC infinitival marker has a single underlying representation containing a number of floating segments, equivalent to the allomorphs proposed by Mascaró (2007). [ɾ] enjoys privileged status in that it is already linked to the only skeletal position provided by the underlying representation for the infinitival marker. This is shown in the Vocabulary Entry in (12) below.

(12) *Vocabulary Entry for* inf *in BEC:*

```
[T, inf] ↔ /  ×            /
              |
              ɾ  n  l  t  s
```

- Let's assume the same set of constraints as in Mascaró, except the mildly modularity violating PRIORITY. We add to this three further constraints to do with structural faithfulness and structural well-formedness:
    - *DELINK: Assign one violation mark for each segment that is delinked from its skeletal position in the input.
    - *EMPTYCATEGORY (*EC): Assign one violation mark for each skeletal position that does not host any melodic material.
    - *FLOAT: Assign one violation mark for every floating segment in the surface structure. (This is triggered by candidates that do not delete the floating material. I assume that there is some counter-acting MAX-type constraint which is outranked by *FLOAT; this is not shown).
- The three constraints above essentially ensure that segments are not delinked needlessly, that floating material is incorporated if possible (*EC) or deleted if not possible (*FLOAT).
- Now let us replace PRIORITY from Mascaro with these three constraints, with the ranking *EC > (AGR/S, …, AGR/C) > *DELINK > *FLOAT (> MAX).
- Let us first look at the case where we expect a TETU effect, i.e. with a vowel-initial enclitic as in [puza-ɾ-u] 'to put it'. This is shown in Tableau 8.

/pɔza-{ɾ̲, n, l, t, s}=u/	ID(nas)	*EC	AGR/S	ID(F)	AGR/C	*DELINK	*FLOAT
a. ☞ puza-ɾ-u							
b. puza-n-u						*!	
c. puza-l-u						*!	
d. puza-t-u						*!	
e. puza-s-u						*!	
f. puza-∅-u		*!				*	

Tableau 8: Deriving BEC overassimilation with a vowel-initial enclitic.

- As we can see in Tableau 8, the initial set of constraints doesn't have any effect because there is no consonantal sequence that could be subject to the AGREE constraints. The form where the [ɾ] is delinked in candidate (f) without attaching another segment is ruled out by *EC, and all the other options where the [ɾ] is delinked and replaced by one of the other segments are eliminated by *DELINK. The effect of *Float is to ensure that all the remaining floating segments are removed from the surface form, i.e. a candidate where [ɾ] was linked but [n l t s] were still floating in the surface form would incur 4 violation marks and so always fare worse than any surface form where there is only a single (or no) floating segment left in the output.

- Let us now consider the case where we find overassimilation to the detriment of [ɾ], as in in [puza-ɾ-lə] ‘to put it.FEM’. This is shown in Tableau 9.

/pɔza-{ɾ̲, n, l, t, s}=la/	ID(nas)	*EC	AGR/S	ID(F)	AGR/C	*DELINK	*FLOAT
a. puza-ɾ-lə					*!		
b. puza-n-lə			*!		*	*	
c. ☞ puza-l-lə						*	
d. puza-t-lə			*!		*	*	
e. puza-s-lə					*!	*	
f. puza-∅-lə		*!				*	

Tableau 9: Deriving BEC overassimilation with a vowel-initial enclitic.

- As can be seen in Tableau 9, the non-agreeing variants are ruled out by the AGREE constraints, which dominate all the structural constraints, so that the variant involving delinking this time fares better because it is the only one that doesn’t violate AGREE/STOP and/or AGREE/C.

4.4.3 Unifying Assimilation and Overassimilation

- Recall that Central Catalan, which BEC is a variety of, has a general assimilation process involving final alveolar stops. Since the alternation triggered here is treated entirely within the phonology, I propose that we can simplify the analysis further and actually partially unify the two processes.
- What I propose is that we can simplify the vocabulary entry for the infinitival marker from (12) to a form containing only two alternants, {ɾ , t}, as shown in (13):

(13) *Vocabulary Entry for* inf *in BEC:*

[T, inf] ↔ / × /
|
ɾ t

- The [t] alternant in (13) could satisfy the Agree constraints by undergoing regular total assimilation to give rise to the allophones [n, l, t, s], however it is trumped by [ɾ], due to the latter's full satisfaction of IDENT(F). This is illustrated for [puza-ɾ-lə] 'to put it.FEM' in Tableau 10. Note that the subindex is used here to keep track of which segment in the input the output segment corresponds to.

/pɔza-{$ɾ_1$, t_2}=la/	ID(nas)	*EC	AGR/S	ID(F)	AGR/C	*DELINK	*FLOAT
a. ☞ puza-$ɾ_1$-lə					*		
b. puza-n_2-lə			*!	*	*	*	
c. puza-l_2-lə				*!		*	
d. puza-t_2-lə			*!		*	*	
e. puza-s_2-lə				*!	*	*	
f. puza-∅-lə		*!				*	

Tableau 10: Deriving BEC overassimilation with a vowel-initial enclitic.

- As can be seen in Tableaux 9 and 10, in principle candidate (c) is still the least marked variant of /t_2/, however /$ɾ_1$/ wrongly wins out since the AGR/C violation is not able to overcome the IDENT(F) violations. Mascaró has however already shown that AGR/C cannot outrank IDENT(F), so we are looking at a possible ranking paradox.
- Not all is lost, there are two possible ways out: AGR/C and IDENT(F) may be tied constraints (ranking equally), which would open new possibilities, or derivation might be cyclical (select the allomorph first, assimilate second. Both of these options require further research.

4.5 Summary

- Many morphophonological alternations involving what looks like phonologically conditioned allomorphy can be accounted for in some way or other within the phonology proper. This is specifically the case for *phonologically optimising* allomorphy.
- Allomorph selection within the phonology is possible in at least some cases without really violating strict modularity, but does involve some modular oddness when they try to actually account for TETU effects.
- However, TETU effects such as BEC overassimilation don't actually have to be accounted for by lexical information, rather they can arise from the specific structure of underlying representations, as argued for by Scheer (2016).
- Consequently, it seems that at least to account for TETU and phonologically optimising allomorphy, we do not need to make reference to a potentially problematic mechanism such as allomorph selection within the phonology.

5. INITIAL CONSONANT MUTATION

5.1 Introduction

5.1.1 What is Initial Consonant Mutation?

- Initial Consonant Mutation (ICM) involves a *phonologically regular process* which alters the initial consonant of words in *morphosyntactically conditioned environments*.
- This is readily apparent from the Welsh examples in (1):

(1)	(a)	/tad/	‘father’	(b)	/kaθ/	‘cat’
		[və n̥ʰad]	‘my father’		[və ŋ̊ʰaθ]	‘my cat’
		[də dad]	‘your.FAM father’		[də gaθ]	‘your.FAM cat’
		[i θad]	‘her father’		[i xaθ]	‘her cat’
		[i tad]	‘his father’		[i kaθ]	‘his cat’

- In (1) we can see that the form of the surface form of the initial consonant of /tad/ ‘father’ depends on the φ-features (person, number) of the possessive pronoun that precedes it. The distinction between ‘her father’ and ‘his father’ in (1) clearly shows that this cannot be accounted for purely phonologically, as the phonological environment in both cases is identical.
- As we can also see, the same language can show several different *mutation pattern*s to signify different information. Table 1 below shows the full mutation patterns of Welsh, where *radical* refers to the underlying form of the initial consonant.

Table 2: The Welsh Mutation Patterns

Radical	p	b	t	d	k	g	m	n	ɬ	r̥ʰ
Soft Mutation (SM)	b	v	d	ð	g	∅	v		(l	r)[1]
Aspirate Mutation (AM)	f		θ		x		(m̥ʰ	n̥ʰ)[2]		
Nasal Mutation (NM)	m̥ʰ	m	n̥ʰ	n	ŋ̊ʰ	ŋ				

([1] Some SM triggers do not affect liquids. [2] Only in some dialects.)

- In addition to the mutation patterns in Table 1, Welsh also has a phenomenon called *Pre-Vocalic Aspiration* (PVA), where following some lexical items, vowel-initial targets are realised with an initial [h], as shown in (2).

(2)	/arð/	‘garden’
	[i harð]	‘her garden’
	[i arð]	‘his garden’

- PVA is often triggered in the same environment as AM, but not all AM environments trigger PVA
- Mutation is a well known feature of all the Celtic languages (Welsh, Breton, Cornish(†), Irish, Scottish Gaelic, Manx(†)), but is also found in many other languages/language families, e.g. Nivkh, Fula, the Mande languages (Mende, Kpelle, …), Iaai, the Numic languages (Comanche, Southern Paiute, …). See Iosad (2010) for a concise cross-linguistic overview.
- Over the next few weeks we’ll focus on the Celtic mutations, and in particular we’ll have an in-depth look at Welsh (one of the most complex ICM systems).

5.1.2 Lexical mutation triggers

- Most mutations are triggered by specific lexical items, and each such *trigger* is associated with a specific mutation pattern. For example:
    - Soft Mutation: /də/ 'POSS.2S', /i/ 'POSS.3SM', /dui/ 'two.F', most prep's, …
    - SM except liquids: /ɨn/ 'one.F', /ə/ 'the.F', …
    - Aspirate Mutation: /i/ 'POSS.3SF', /xwe/ 'six', /a/ 'and', /tri/ 'three.M', …
    - Nasal Mutation: /və/ 'POSS.1S', /ən/ 'in', …
- As we can see readily from the list above, the relationship between the mutation pattern an item triggers (or whether it triggers mutation at all!) and its morphosyntactic features are completely *arbitrary*, though we can also notice that feminine gender features heavily (we'll have more to say about this at some point).

5.1.3 Structural mutation triggers

- Sometimes mutations are triggered where there is no clear lexical trigger preceding the mutation *target*. Structural mutation in Welsh always involves Soft Mutation.
  In Welsh, structural mutation is triggered by:
    (1) Prenominal adjectives (e.g. /hen/ 'old'); note that normally adjective are postnominal, much like in French. Because only very few adjectives regularly occur pre-nominally, these are sometimes treated like lexical triggers.
    For example: /ɬivr/ 'book' → [ər hen l̲ivir] 'the old book'.
    (2) Direct objects in synthetic VSO clauses (but not in periphrastic AuxSVO).
    For example: /beɪk/ 'bike' → [prənɔð vɔ v̲eɪk] 'He bought a bike'.
    (3) Postnominal modifiers of feminine nouns.
    For example: /dɨ/ 'black' → [ə ð̲ənes (ivaŋk) ð̲ɨ] 'the (young) black woman'.

5.1.4 Adjacency condition

- There are two adjacency conditions that hold of ICM in most systems studied (there are some problematic cases in Irish and Welsh, which we'll turn to later).
- For lexical mutation triggers, targets must be *string adjacent* to the lexical trigger, e.g. [kaθ] 'cat' → [i x̲aθ] 'her cat', but [i hen g̲aθ] 'her old cat', not *[i hen xaθ].
  This condition is often referred to as the *Trigger Constraint*, formally defined in (3).
    (3) A triggers mutation on B iff:
    (i) A is a lexical trigger of mutation;
    (ii) A is string adjacent to B at PF;
    (iii) A precedes B at PF.
- For structural mutation, the targets must be the first item in their domain, e.g. [hen g̲aθ] 'old cat', but [hen g̲aθ | ki | a hogan] 'old cat, dog and boy';
  [darɬeneʃ i pedwar ɬivir/*l̲ivir] 'I read.PST four books'.

5.1.5 Target and trigger variation

- Variation among mutation targets is essentially limited to one kind: some items take part in mutation, and some resist mutation altogether. For example, as seen in (1), *ci* ‘dog’ and *cath* ‘cat’ take part in mutation. In contrast, the adjective *braf* ‘splendid’ does not mutate, as shown by the examples in (4).

(4)					
(a)	/brav/	‘splendid’	(b)	/bras/	‘thick’
	[ki brav]	‘splendid dog’		[ki bras]	‘thick dog’
	[kaθ brav]	‘splendid cay’		[kaθ vras]	‘thick cat’
	But: *[kaθ vrav]			But: *[kaθ bras]	

- The lexical distribution of *immutable* items is very limited, perhaps a few hundred. Apart from proper names they are not systematic. We’ll talk more about this later on.
- There is one exception to the above generalisation on target variation, namely the words for ‘anniversary’, ‘year’, and ‘day’ have an “unexpected” NM reflex after high numerals where no other target shows mutation.
- Trigger variation on the other hand is very common:
  - Some triggers give rise to a Mixed Mutation, where /p, t, k/ are spirantised to [f, θ, x] as in AM and /b, d, g, m, ɬ, r̥^{h}/ are spirantised or voiced as with SM.
  - Some SM triggers fail to affect words with initial /ɬ, r̥^{h}/.
  - Some lexical triggers trigger both PVA and AM, some only AM, and some only PVA.
  - In some dialects some of the patterns are reduced or modified, some triggers have become hyperspecific to only trigger mutation with specific targets, some triggers have been partially lost, …
- In summary, the locus of idiosyncratic variation in Welsh (and in mutation systems in general) seems to be the triggers, not the targets. Targets generally only vary in whether they take part in mutation or not.

5.1.6 Rule-based approaches to ICM

- There have been a number of attempts to account for the phonological regularity and productivity of mutations by implementing the mutation patterns themselves as part of a rule-based phonological component.
- Awbery (1973, 1975) initially proposed that mutations are effected by regular phonological rules which make direct reference to morphosyntactic environments, e.g. voiceless plosives are voiced in direct object position. She argued that mutation in essence shows that phonology must be able to make such direct reference to morphosyntactic environments.
- Ball & Müller (1992) also proposed implementing mutations as regular phonological rules. However, rather than direct reference, they proposed that the targets are annotated with diacritic features such as [SM] in the syntax. These diacritic features are passed across the interface to the phonology, where we can now have rules that are sensitive to these features, e.g. [–voi, –cont] → [+voi] / ##__ SM##.
- Kibre (1997) assumed a Lexical Phonology framework, and put rules effecting mutation into the lexical rule component at the stage of word formation, rather than the regular phonology, based on the assumption that this (i) means that diacritic features don’t have to feature in the regular phonology, and (ii) regular phonology is never aware of mutation and doesn’t have to implement non-optimising/non-independent rules. Otherwise the account is fairly similar to Ball & Müller (1992) in nature.

5.1.7 Appraisal

- ICM involves a productive phenomenon with a phonologically regular change taking place in a morphosyntactically conditioned environment.
- It appears as though phonology here must be somehow sensitive to morphosyntactic information, in direct contradiction to predictions of the strict modularity hypothesis.
- Thus, mutation is clearly challenging for morphophonologists, and potentially problematic for strict modularists.

5.2 Full target suppletion – Green (2006)

5.2.1 Against ICM as a phonological process I: Non-adjacency in Irish

- While virtually all research on ICM assumes the trigger constraint in (3) to hold cross-linguistically and mandate phonological adjacency, Green (2006) argues that Irish actually violates the trigger constraint. Let's discuss the three cases he raises in turn.
- Firstly, *dhá* 'two' is a regular trigger of Lenition (a mutation pattern similar to SM) in Irish, so we have *teach* 'house' but *dhá <u>th</u>each* 'two houses'.
  However, when preceded immediately by a possessive pronoun, the mutation on the target will be whatever the possessive pronoun triggers, and not necessarily the Lenition pattern expected after *dhá*. This is illustrated in (5) below.

(5) (a) *mo dhá <u>th</u>each* 'my two houses'
(b) *do dhá <u>th</u>each* 'thy two houses'
(c) *a dhá <u>th</u>each* 'his two houses'
(d) *a dhá teach* 'her two houses'
(e) *ár dhá <u>dt</u>each* 'our two houses'
(f) *bhur dhá <u>dt</u>each* 'your two houses'
(g) *a dhá <u>dt</u>each* 'their two houses'
(h) *dhá <u>th</u>each* 'two houses'

- As can be seen in (5a-d) we find Lenition after the first, second and third-masculine singular, but no mutation after the third-feminine. In the plurals in (5e-g) we find Eclipsis in every instance. As (5h) shows, in the absence of a pronoun (aka the elsewhere environment), *dhá* triggers Lenition.
- If the trigger constraint was correct, Green argues, then *dhá* should absorb the mutation from the pronoun because it is string adjacent to the right of the pronoun, and it should always trigger Lenition on the item to its right.
- Green (2006) argues that the behaviour of *dhá* shown in (5) means that mutation in Irish cannot be due to floating phonological material (recall Catalan) at the right edge of the trigger that might then be incorporated into the onset of the target. For him, this essentially rules out phonological accounts of mutation – the only option is that mutation must be target suppletion in the context of certain triggers.
- However, the situation is not as dire as Green makes it out to be:
  - The numeral 'two' shows extensive suppletion itself. *Dhá* is used only as a quantifying adjective (e.g. *X number of Y's*), in counting years, and as an inanimate pronominal (*John has two*, where *two* refers to some entity such as *books, houses, tables, ...*). In animate pronominal use (i.e. where *two* in *John has two* refers to *friends, daughters, pets, ...*) the exponent of 'two' is *dís*. In all other cases (e.g. counting, time, maths, giving numbers) the exponent of 'two' is *dó*.

- Given that we have at least three vocabulary entries here already, which are also sensitive to syntactico-semantic features, it is readily conceivable that *dhá* itself has several versions sensitive to φ-features, e.g. Eclipsis-triggering-*dhá* for plurals, non-mutation-triggering-*dhá* for feminine gender, and Lenition-triggering-*dhá* for everything else. This would be no different than e.g. the shapes of the pronoun *a* 'his, her, their' themselves.
- It is also conceivable that whatever triggers mutation after pronominals is actually not contiguous with the pronoun in cases such as (5a-g). That is to say, suppose that the mutation after pronouns is triggered by a syntactic terminal such as *Num*, rather than by the pronoun in *D* itself. If *dhá* cliticises to D, we'd expect exactly the behaviour in (5) and the trigger (namely Num) will still be adjacent to the target, it just doesn't have an over exponent.

- The second case of apparent non-adjacency discussed by Green (2006) is mutation in conjoined phrases under coordination, as shown in (6).

(6) (a) *sioc agus sneachta* 'frost and snow'
(b) **sioc agus shneachta* 'frost and snow'
(c) *trí shioc agus shneachta* 'through frost and snow'

- As can be seen in (6a-b), *agus* does not itself trigger Lenition. However, if a trigger of Lenition precedes *agus* as in (6c), then both of the conjoined nouns are lenited.
- It is not clear whether the phenomenon in (6) also applies to Eclipsis, the other mutation pattern in Irish, or whether it is limited to Lenition. It is also unclear how consistently this pattern is applied, whether there are any modifiers that do not trigger mutation on both conjoined items, and what role semantic scope plays in the structures.
- If it turned out that mutation here signals a scope contrast, e.g. if speakers turn out to contrast sentences such as ?*dhá úll agus phiorra* 'two apples and (two) pears' from ?*dhá úll agus piorra* 'two apples and (a) pear', it may be possible to construct the argument that the modifier involved in these structures is underlyingly present twice, but only the higher copy is overtly spelled out, thus tacitly preserving string adjacency. But even this would perhaps not be an entirely satisfactory account.
- There remains much work to be done in understanding this phenomenon, and it seems clearly problematic for accounts relying on string adjacency/the trigger constraint. However, as we will see shortly, accounts without a trigger constraint such as Green's are actually also unable to account for this phenomenon–it remains a problem for all.
- The third case raised by Green (using data from Stenson 1990) is the behaviour of the expletive *fuckin'*, which appears to be invisible to mutation, as shown in (7).

(7) *Cá bhfuil mo fuckin' sheaicéad?* (<*seaicéad*)
'Where's my fucking jacket?'

- Again, relatively little research has been done on such cases specifically with regard to their mutation behaviour. However, Breit (2012), studied the behaviour of the two expletives *ffwcin* 'fucking' and *blydi* 'bloody' in Welsh intervening between an AM trigger and a target in seven speakers of North Welsh:
  - Breit administered a translation task to seven speakers of North Welsh.
  - The expletives were inserted between an AM trigger and a target (e.g. "her fucking cat"). If the expletive is transparent, the target should show AM. If the expletive is used like a regular prenominal modifier, the target should show SM. If the expletive behaves like any other intervening word, it should block AM but may not itself trigger a mutation.

- It was found that there was a great deal of variation, both within and across speakers, and for some speakers across the two expletives used.
- Expletives were treated as though they were syntactically not present about half of the time, and they blocked mutation without themselves triggering mutation in the vast majority of remaining cases. Only in very few instances did they function like regular prenominal modifiers (i.e. absorbing AM and triggering SM themselves).
- Breit (2012) hypothesised that the variability here shows that speakers struggle to integrate these items into the system, but that it is perhaps most plausible to analyse them as a case of infixation (similar to expletive infixation in English), with early infixation leading to a blocking effect and late infixation leading to transparency effects.
- If such an analysis can be corroborated by further research, it would show that such cases are not necessarily problematic in terms of the trigger constraint.

- Green (2006) concludes that these three cases clearly show that the trigger constraint cannot hold in Irish, and further infers from this that if it doesn't have any formal status in Irish, then it doesn't have any formal status in any of the Celtic languages.
- However, as we have seen, the evidence presented is far from clear and sufficient in ruling out the trigger constraint. However, even if the trigger constraint were violated in Irish, Green's argument that therefore it doesn't have any status in the other Celtic languages in fallacious. Just because they are from the same language family and show a similar phenomenon doesn't mean that the grammatical implementation of that phenomenon will be exactly identical in all these languages. [7]

5.2.2 Against ICM as a phonological process II: Harmonic paradoxes in Manx

- Green (2006) argues that evidence from Manx rules out a phonological analysis of mutation, even where the triggering environment can somehow be captured in the phonology.
- Unlike any of the other Celtic languages, Manx both has a mutation pattern called Lenition (similar to Irish Lenition and Welsh SM in nature) and a regular phonological lenition process that takes place word-internally.
  The two patterns are compared side-by-side in Table 2.

Table 3: Initial Consonant Mutation compared to regular phonological lenition in Manx

Radical	*ICM Lenition*	*Phonological lenition*
p$^{(j)}$	f	b~v
t$^{(j)}$	h~x$^{(j)}$	d~ð
k$^{(j)}$	h~x$^{(j)}$	g~ɣ
b	w~v	v
d / d^{j}	ɣ / j	ð
g / g^{j}	ɣ / j	ɣ
m	w~v	
f	∅	
s / s^{j}	h / h~x^{j}	ð~z
x		ɣ~h~∅

[7] Specifically, this is an instance of the Association Fallacy.

- Example (8) below illustrates ICM Lenition in Manx, and example (9) shows regular phonological lenition.

(8) /kreːwən/ 'bones' /dulis^j/ 'Douglas (capital of Isle of Man)'
[mə x̠reːwən] 'my bones' [də ɣ̠ulis^j] 'to Douglas'
(9) /fiːkəl/ 'tooth' /tapi/ 'quick'
[fiːkəl~fiːɣəl] 'tooth' [tabi~tavi] 'quick'

- Green argues that if ICM Lenition is somehow encoded in the phonology, this means that the mutated forms must under the right conditions be more harmonic (more optimal) than the radical forms, i.e. it must be the result of constraint ranking.
- Similarly, regular lenition in Manx must be the result of the lenited forms being more harmonic/optimal than the radical forms, i.e. phonological lenition in Manx must also be the result of constraint ranking.
- Under ICM Lenition in Manx plosives are spirantised or debuccalized but retain their voicing-contrast. Under regular phonological lenition, there is also a loss of voicing contrast.
- Regular phonological lenition does not target /m, f/, but ICM Lenition does. Regular phonological lenition targets /x/, but ICM Lenition doesn't.
- Green argues that, while we can encode ICM Lenition phonologically be ranking constraints in a certain way, and we can encode regular phonological lenition be ranking constraints in a certain way, whichever ranking we produce will invariably produce either ICM Lenition or phonological lenition, but because the outcomes and sounds affected are different, both cannot be produced at the same time (in OT this situation is referred to as a ranking paradox or a harmonic/optimality paradox).
- Tableau 1 below shows a ranking that derives phonological lenition in Manx. As shown in Tableau 2, if we pluck in a form undergoing ICM Lenition instead, this ranking does not derive the correct result.

/tapi/	IDENT(pl)	*V[–voi]V	*V[–cont]V	IDENT(voi)	IDENT(cont)
a. tapi		*!	*		
b. tabi			*!	*	
c. ☞ tavi				*	*
d. tafi		*!			*
e. tahi	*!	*			*

Tableau 11: /p/ to [v] under phonological lenition in Manx.

/mə kreːwən/	IDENT(pl)	*V[–voi]V	*V[–cont]V	IDENT(voi)	IDENT(cont)
a. mə kreːwən		*!	*		
b. mə greːwən			*!	*	
c. 💣 mə ɣreːwən				*	*
d. mə xreːwən		*!			*
e. mə hreːwən	*!	*			*

Tableau 12: Failure to derive /k/ to [x] under ICM in Manx.

- To fix Tableau 2, we'd have to move IDENT(voi) to the top, but if we did that it would lead to the wrong result in Tableau 1, where it would rule out candidate (c), as shown in Tableau 3.

/tapi/	IDENT(voi)	IDENT(pl)	*V[–voi]V	*V[–cont]V	IDENT(cont)
a. tapi			*	*!	
b. tabi	*!			*	
c. tavi	*!				*
d. 💣 tafi			*		*
e. tahi		*	*!		*

Tableau 13: Failure to derive /p/ to [v] with alternate ranking (cf. Tablea 1).

- Additionally, Green submits that the fact we see non-debuccalised [ð, ɣ] surface as a result of regular phonological lenition means that [ð, ɣ] must be good surface phones in Manx, so there is not grammatical motivation to debuccalise under ICM Lenition.
- Here again, Green applies the reasoning that because mutation in Manx is not phonologically optimising and therefore cannot be phonological in nature, it stands to reason that it isn't phonologically implemented in any of the Celtic languages.

5.2.3 Mutation as root suppletion

- Given that mutations cannot be successfully analysed as part of the phonology, Green (2006) suggests that they must be suppletive.
- Green suggests that mutation triggers are marked with a diacritic feature such as [+SM] if they trigger Soft Mutation, or [+AM] if they trigger Aspirate Mutation, and so forth.
- Mutation targets have a set of lexically listed allomorphs which are annotated with a matching mutation feature [SM], [AM], etc. as shown in (10) for Welsh *cath* 'cat':

(10) *cath:* kaθ$_{RAD}$
gaθ$_{SM}$
xaθ$_{AM}$
ŋ̊^{h}aθ$_{NM}$

- This means every single item in a mutation language will have at least one allomorph per mutation pattern in that language. If we take into account the most common complications in Welsh, we need a form for the radical, SM, defective SM, AM, PVA, AM+PVA, NM, and MM. That is, Green's proposal implies that every vocabulary item/lexical entry in Welsh has at least 8 allomorphs, thus massively inflating the amount of information speakers must have memorised.
- Mutation then boils down to a condition on allomorph selection, where the allomorph selected for the target has to agree in the mutation feature with the mutation trigger.

5.2.4 Allomorph selection within phonology

- Green (2006) proposes that allomorph selection happens inside the phonological component, similar to Mascaró (2007).
- Because Green rejects the trigger constraint, he proposes that instead what matters is the relationship of syntactic government. A mutation trigger has to syntactically govern it's target to effect mutation.
- Based on this, Green proposes a constraint MUTATION AGREEMENT (MUTAGREE):

(11) MUTAGREE: Assign 1 violation mark for every word whose mutation-diacritic in the output does not agree with the mutation-diacritic of its syntactic governor in the input.

- MUTAGREE is very highly ranked and can now derive both the mutation reflex and regular phonological lenition simultaneously, as illustrated in Tableau 4 for Manx /ə beːtə/ 'the boat'.

/ə$_{\text{LEN}}$ {beːtə$_{\text{RAD}}$, veːtə$_{\text{LEN}}$ }/	MUTAGREE	ID(pl)	*V[–voi]V	*V[–cont]V	ID(voi)	ID(cont)
a. ə$_{\text{LEN}}$ beːtə$_{\text{RAD}}$	!*		**	*!*		
b. ə$_{\text{LEN}}$ beːðə$_{\text{RAD}}$	!*		*	*	*	*
c. ə$_{\text{LEN}}$ veːtə$_{\text{LEN}}$			*!	*		
d. ☞ ə$_{\text{LEN}}$ veːðə$_{\text{LEN}}$					*	*

Tableau 14: Correct derivation of ICM and phonological lenition in Manx.

- One of the reasons Green assumes that allomorph selection happens is that it can apparently be overruled by phonological concerns: In Irish, cornal-final triggers fail to trigger mutation on coronal-initial targets. This is easily accounted for in Green's account by proposing an additional constraint CORHOM (coronal homorganicity) which mandates that sequences of coronals must be faithful to their place features. This constraint then outranks MUTAGREE (see Green 2007 for discussion of this).
  However, Ní Choisáin (1991) has proposed an analysis where coronal-sequences share the same coronal feature across the word-boundary as part of regular phonology, thereby evading mutation even where mutation is treated as implemented in the normal phonology.

5.2.5 Problems with Green's account

- Relies on module-transcending diacritic features which violate strict modularity by passing on morphosyntactic information "through the back door."
- MUTAGREE is a phonological constraint that makes explicit reference to a syntactic relation (syntactic government). This is not compatible with modularity, and much worse an offense than e.g. Mascaró's PRIORITY constraint.
- MUTAGREE doesn't actually account for the apparent violations of the trigger constraint that Green is concerned with:
  - Take the definition of syntactic government in (12) (Haegeman 1994:479):

    (12) GOVERNMENT (SYNTAX):
    A governs B iff:
    (i) A is a governor;
    (ii) A m-commands B;
    (iii) no barrier intervenes between A and B;
    (iv) minimality is respected.
  - Governors in (12) are syntactic heads (e.g. categories such as A, N, V, P, or I), and barriers are constituted by most XPs. Minimality is violated if another potential governor of B intervenes between A and B.[8]

[8] MINIMALITY (SYNTAX):
A governs B iff there is no node Z such that:
(i) Z is a potential governor for B;

- Revisiting the example of *dhá* 'two', in a phrase such as *ar dhá gcuid* 'our two parts', because both *ar* 'our' and *dhá* 'two' are mutation triggers, these must both be heads and potential governors. Since *dhá* c-commands *cuid* 'part' and *ar* c-commands both *dhá* and *cuid*, it follows that *dhá* governs *cuid* but *ar* cannot govern *cuid* without violating condition (iv) of government, minimality. Therefore an account based on syntactic government cannot account for the behaviour of *dhá* in the data Green highlights and in fact makes the exact wrong prediction, namely that *dhá* should always be the mutation trigger here.
- Similarly, in coordination structures, in order to be transparent, Green's account would require us to assume that the coordinating conjunction itself is neither a governor itself (which would again violate minimality) nor a barrier. However, in Welsh *a* 'and' triggers AM, meaning it has to qualify as a governor under Greens account, meaning that again we cannot account for the apparent transparency effects of the coordinating conjunction.

- The claim that mutation in Manx cannot be phonologically optimising because ICM Lenition has a different pattern to phonological lenition in the language is not really valid, because it neglects to take into account the fact that these two phenomena never occur in the same phonological environment: ICM Lenition occurs only word-initially, phonological lenition occurs only intervocallically and word-internally. So they can be teased apart easily in the phonology by reference to this environment–and in fact, a division between these environments in not uncommon: we often find fortition word-initially and lenition word-internally between vowels.
- Full lexical listing of many different entries is very costly in terms of memory. The total amount of phonological information stored lexically is anywhere from double (for a language like Manx) to 8-fold+ (for a language like Welsh).
- Accounting for mutation as target suppletion predicts that targets should be the locus of irregularities and exceptions, but these are very systematic (mutate or don't), while triggers are really the locus of variation in mutation systems. Yet, in this system, theoretically for every variation in the triggers we potentially need a new diacritic.
- Overall, a lot of Green's reasoning relies on the assumption that just because the different Celtic languages have a common origin and similar mutation phenomena, they must all be implemented the same in the respective grammars. However, there is no a priori justification that allows us to reason across language boundaries in most of the cases that are critical for his account. In fact, many other parts of the languages' grammars and phonologies are different, so why should mutation always work the same way?[9]

5.3 Pattern extraction – Hannahs (2013)

5.3.1 Pattern extraction and partial suppletion

- Hannahs (2013) agrees with Green's (2006, 2007) assessment that mutation are not in any sense derived actively by phonology, but takes issue with the full listing approach proposed

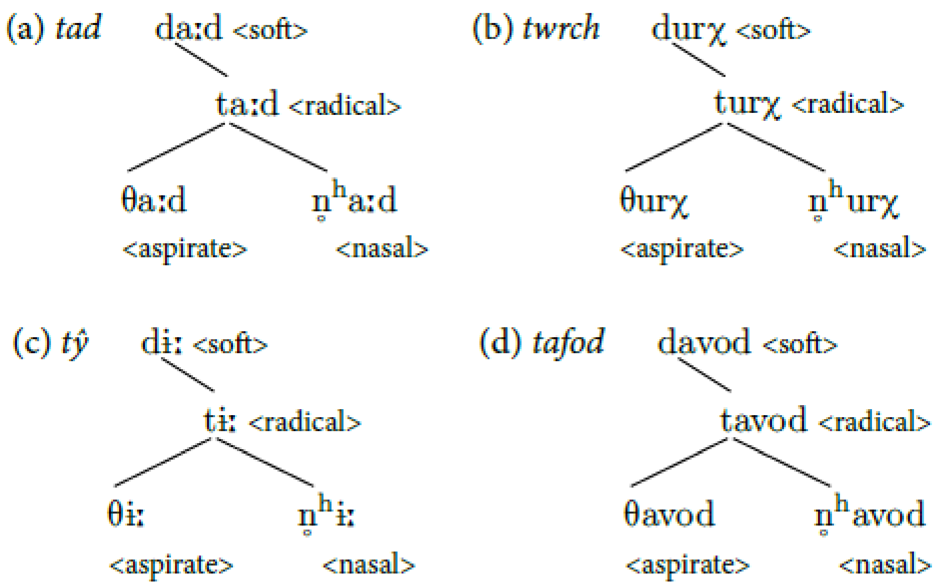
(ii) Z c-commands B;
(iii) Z does not c-command A.
(cf. Haegeman 1994:479)

[9] Note that this is a different question from: are there any common constraints that all mutation systems across languages respect, possibly for reasons of architecture/UG?

by Green, because it shows large redundancy and fails to give any clear attribution to the fact that there are relatively consistent patterns involved.

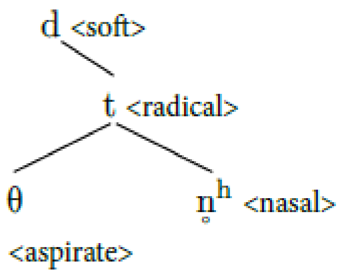
- Instead of full lexical listing, Hannahs (2013) proposes a novel mechanism of pattern extraction.
- Pattern extraction first involves that speakers build associated schemata for the alternants found in different environments (which are marked by diacritics similar to Green's account, here called <soft>, <aspirate>, etc.), as shown in (13).

(13)



- From the repeated recurrence of the associations in (13) in their lexicon, speakers are then able to extract a generalised pattern applicable to items with word-initial /t/, as shown in (14).

(14)



- Speakers are able to infer from the generalised schema in (14) that the extracted pattern will apply to all words with initial /t/. This is what Hannahs (2013:8) claims allows speakers to apply mutation to novel forms and neologisims, such as *teledu* 'television', while a full listing system such as that of Green (2006) does not predict the productivity of the system.
- It is however unclear whether the extracted patterns in (14) exist as independent entities which are then linked to by other lexical entries, or whether each lexical entry has its own stratified initial consonant. The former makes it perhaps difficult to account for immutability.
- This is clearly a novel conception of what the lexicon can do/what lexical representation entails, similar in nature to the templatic morphology of Semitic languages. What may be disconcerting is that it ascribes to the lexicon the power to meaningfully assemble/disassemble structurally simplex phonological forms (thus giving the lexicon essentially the power to manipulate phonological forms, and to do so possibly in a way that regular phonology cannot).

- Whichever of the possible options is adopted, a crucial differentiating factor of Hannahs' model is that only the initial consonant is subcategorised for individual mutation environments, not the entire word form as with Green's proposal. This is lexically much more economical, and does not make the odd prediction that we might find arbitrary suppletive forms in different mutation environments (e.g. there is nothing preventing Green's system from having a radical [dad] with a SM reflex [mam] or [lop] or whatever unrelated form, just as with true fully suppletive forms such as *bad~worse* in English).

5.3.2 Subcategorisation at VI

- Rather than having allomorph selection take place within the phonology, Hannahs (2013) proposes that the correct form is determined at the point of vocabulary insertion.
- As with Green's account, the lexical alternants have a diacritic mark associated with each of the mutation reflexes. Triggers, rather than carrying a diacritic directly, are associated with *subcategorization frames* in the lexicon, which are essentially conditions on the environment in which the item may appear.
- For instance, the preposition *â* 'with' in Welsh will be associated with the subcategorization frame in (15) (cf. Hannahs 2013:13).
  (15) *â:* Prep, [___ X$_{\langle aspirate \rangle}$]$_{PP}$

The subcategorization frame in (15) says that *â* can only be inserted into a syntactic terminal of the category *Prep*, at the left edge of a PP which has a complement X that bears the diacritic feature <aspirate>. So, if we were to try and insert a radical or Soft Mutation form for X, then *â* could not be inserted and the derivation would crash.

- More controversially than the case in (15) where the lexical entry for a specific item (the preposition *â*) has an associated subcategorization frame, Hannahs proposes that there are also subcategorization frames entirely independent of specific lexical entries.
- Such independent subcategorization frames, he proposes, are found for instance in direct object mutation (which can be characterised more generally as SM on the first item of a maximal projection that is the sister of its c-commanding maximal projection (cf. e.g. Tallerman 2006). Thus, the SM found on *beic* in the phrase *prynodd fo v̲eic* 'he bought a bike' is the result of the subcategorization frame in (16).
  (16) [...]$_{XP}$ [___$_{\langle soft \rangle}$ ...]$_{XP}$
- Unbounded subcategorization frames such as (16) are extremely powerful devices, because they are neither triggered by the presence of a specific morphosyntactic terminal nor are they bound to a specific domain of reference or specific morphosyntactic features. Allowing this would open the doof to many kinds of potentially highly undesired, problematic and unattested suppletion patterns. For instance suppletion triggered across phase boundaries, suppletion conditioned by position within a phrase rather than adjacency to some terminal, suppletion that skips intermediate heads, and other patterns normally ruled out by well-attested morphosyntactic locality requirements.

5.3.3 Advantages and problems of Hannah's account

- Hannahs' account is lexically more efficient than Green's account, and also predicts productivity of the system while eliminating an unattested type of full suppletion in mutation environments, which Green doesn't.
- Placing the suppletion process at the point of VI rather than in the phonology is much less problematic in terms of modularity: no reference to morphosyntactic information in the

phonology, and non-module-transcending diacritics are much less problematic than module-transcending ones. However, Hannahs' does have to assume a new type of lexical construct and process that is potentially violating modularity by letting the lexicon manipulate phonological structures. Under a strictly modular account, whatever our view of the lexicon, it should not be able to interpret or carry out computations on the phonological forms of individual items. Pattern extraction is thus a modularity defending device, simply shifting the violating environment from the morphosyntax-phonology interface to the interface with the lexicon.

- Being a target suppletion account, Hannahs' account is subject to the same criticism of misplacing the locus of variation onto the target, rather than onto the trigger.

REFERENCES

Arregi, K. and Nevins, A. (2012) *Morphotactics: Basque Auxiliaries and the Structure of Spellout.* Dodrecht: Springer.

Awbery, G. M. (1973) Initial mutation in a generative grammar of Welsh. *University of Leeds Phonetics Department Report,* 4:28-46.

Awbery, G. M. (1975) Welsh mutations: syntax or phonology? *Archivum Linguisticum*, 6:14-25.

Ball, M. & Müller, N. (1992) *Mutation in Welsh.* London: Routledge.

Bobaljik, J. D. (2017) Distributed Morphology. In: Aronoff, M. (ed.), *Oxford Research Encyclopedia of Linguistics.* Oxford: Oxford University Press.

Breit, F. (2012) Coping with borrowed swearwords: Anomalies in Welsh mutation patterns. Poster presented at the Bangor Summer School in Bilingualism, 25 July 2012, Bangor University.

Breit, F. (2019) *Strict modularity and Welsh mutation*. PhD thesis, University College London.

Chomsky, N. (1981) *Lectures on Government and Binding: The Pisa Lectures.* Dodrecht: Foris Publications.

Chomsky, N. (1993) A minimalist program for linguistic theory. In Hale, K. & Keyser, S. J. (eds.), *The view from Building 20: essays in linguistics in honor of Sylvain Bromberger,* 1-52. Cambridge, MA: MIT Press.

Chomsky, N. (1995) *The minimalist program.* Cambridge, MA: MIT Press.

Coltheart, M. (1999) Modularity and cognition. *Trends in Cognitive Sciences*, 3(3):15-220.

Faust, N. (2014) Where it's [at]: A phonological effect of phasal boundaries in the construct state of Modern Hebrew. *Lingua,* 150: 315-331.

Green, A. D. (2006) The independence of phonology and morphology: The Celtic mutations. *Lingua*, 116(11):1946-1985.

Green, A. D. (2007) *Phonology Limited*, vol. 27 of *Linguistics in Potsdam*. Potsdam: Universitätsverlag Potsdam.

Haegeman, L. (1994) *Introduction to Government & Binding Theory*, 2nd ed. Oxford: Oxford University Press.

Hale, M. & Reiss, C. (2008) *The Phonological Enterprise*. Oxford: Oxford University Press.

Halle, M. and Marantz, A. (1993) Distributed Morphology and the pieces of inflection. In Hale, K. & Keyser, S. J. (eds.), *The view from Building 20: essays in linguistics in honor of Sylvain Bromberger*, 111-176. Cambridge, MA: MIT Press.

Harley, H. (2014) On the identity of roots. *Theoretical Linguistics*, 40(3-4):225-276.

Harley, H. and Noyer, R. (1999) Distributed Morphology. *Glot International*, 4(4):3-9.

Iosad, P. (2010) Right at the left edge: Initial consonant mutations in the world‘s languages. In Michael Cysouw and Jan Wohlgemuth (ed.), *Rethinking universals: How rarities affect linguistic theory*, 105–138. Berlin: Mouton de Gruyter.

Jackendoff, R. (1997) *The architecture of the language faculty.* Cambridge, MA: MIT Press.

Kibre, N. J. (1997) *A Model of Mutaiton in Welsh.* Bloomington, IN: Indiana University Linguistics Club Publications.

Liberman, A., Cooper, F., Shankweiler, D. & Studdert-Kennedy, M. (1967) The perception of speech code. *Psychological Review*, 74:431-461.

Lowenstamm, J. (2012) *German Umlaut: An Outline of a Minimalist Account*. Ms., Université Paris Diderot & CNRS.

Mascaró, J. (2007) External Allomorphy and Lexical Representation. *Linguistic Inquiry*, 38(4): 715-735.

Merchant, J. (2015). How much context is enough? Two cases of span-conditioned stem allomorphy. *Linguistic Inquiry*, 46(2):273-303.

Miller, P. H., Pullum, G. K. & Zwicky, A. M. (1997) The Principle of Phonology-Free Syntax: four apparent counterexamples in French. *Journal of Linguistics*, 33:67-90.

Nevins, A. (2016) *Lectures on Postsyntactic Morphology*. Ms, lingbuzz/002587.

Newman, A. J., Ullman, M. T., Pancheva, R., Waligura, D. L. & Neville, H. J. (2009) An ERP study of regular and irregular English past tense inflection. *NeuroImage*, 34(1): 435-445.

Prince, A. & Smolensky, P. (1993) Optimality Theory: Constraint interaction in generative grammar. *Technical Report CU0CS-696-93*, Department of Computer Science, University of Colorado at Boulder.

Pylyshyn, Z. W. (1999) Is vision continuous with cognition? The case for cognitive impenetrability of visual perception. *Behavioral and Brain Sciences*, 22(3):341-423.

Scheer, T. (2012) *Direct Interface and One-Channel Translation: A non-diacritic theory of the Morphosyntax-Phonology Interface.* Berlin: De Gruyter Mouton.

Scheer, T. (2016) Melody-free syntax and phonologically conditioned allomorphy. *Morphology*, 26: 341-378.

Segal, G. (1996) The modularity of theory of mind. In Carruthers, P. & Smith, P. K. (eds.), *Theories of theories of mind,* 141-157. Cambridge: Cambridge University Press.

Siddiqi, D. (2010) Distributed Morphology. *Language and Linguistics Compass,* 4(7):524-542.

Stenson, N. (1990) Phrase structure congruence, government, and Irish-English code-switching. In: Hendrick, R. (ed.), *The Syntax of the Modern Celtic Languages*, vol. 23 of *Syntax and Semantics*, 167-197. San Diego, CA: Academic Press.

Sung, E.-K. (2005) Allomorph selection in Korean. *Studies in Phonetics, Phonology, and Morphology,* 11(1):45-64.

Tallermann, M. (2006) The syntax of Welsh "direct object mutation" revisited. *Lingua,* 116(11):1750-1776.

Trommer, J. (2008) Multiple-Feature Mutation and Realize Morpheme. In Heck, F., Müller, G. & Trommer, J. (eds) *Linguistische Arbeitsberichte 87: Varieries of Competition*, 163-182.

Zwicky, A. M. (1969) Phonological constraints in syntactic descriptions. *Papers in Linguistics,* 1(3):411-463.